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THE MOONLIGHT SCHEDULE.

We lay before our central-station readers, as usual at this season of the year, the Moonlight Schedules which have been prepared by Mr. Henry W. Frund for 1909. Their value and usefulness have now been attested by 21 years of service, as well as by the inquiries we receive for them and by their adoption by the National Electric Light Association. A few points of explanation will be found elsewhere in our pages. For the convenience of our readers in the execution of their contracts where schedules are involved, the tables are issued as a Supplement, which should be found with each copy of the ELECTRICAL WORLD.

MORE REGULATION.

Last week in the United States Senate, Mr. Dolliver introduced a bill placing telegraph and telephone companies engaged in interstate business under the provisions of the Interstate Commerce Commission "for the purpose of better protecting the people against unreasonable rates and charges." This is understood to be an Administration measure, and it will be remembered that Senator Dolliver was a favorite with President Roosevelt as a running mate for Judge Taft, but somehow was not supported by his fellow Iowans. Whether under the rather strained relations between the President and Congress, over the recent message and the reference to secret service, such a bill will have much chance of enaction seems doubtful, but it is certainly another sign of the irresistible tendency to establish vigilant control over the great corporations in all fields. We do not know of much real reason or demand for relief just now. Neither the telegraph nor the telephone companies are making much money, but they are to be watched so that they shall not be swamped with profits in the future.

Among the States the same drift continues. The tentative scheme for Connecticut has just been issued by the Commission on the subject, and is under criticism and comment before the final report and bill are to be drafted for the General Assembly. This scheme goes further than the New York law in subjecting telephone companies to jurisdiction; but seems to ignore the telegraph, which cuts little figure in the State as to any local incorporation. Another new feature is the subjecting of dams and reservoirs to mandatory supervision. Local inspectors of gas and electric meters are also provided for, and, of course, full powers are taken on as to settling complaints, fixing rates, ordering service, etc.

In Vermont, it may be noted, legislation has been pending in the House of Representatives as to State control of public service corporations. The Vermont Electrical Association has done some active work in general support of a bill which follows pretty closely the lines of the Wisconsin law; while the Administration had a bill presented following analogous lines advocated during the political campaign. It appears, however,

that the independent telephone companies, which still balk at connection and interchange with other systems, did not "come into camp" with their electrical colleagues in the other branches. It now looks as though the committee will have to report the bill unfavorably, which would probably kill it in the House. It stands to reason that a measure is deprived of its chances of possible adoption when those most affected by its terms cannot themselves agree on essentials.

Tungsten Arches in Small Towns.

The quantity of light obtainable from series tungsten street lamps at a reasonable expense bids fair to revolutionize the lighting of the business districts of small towns if the example being set by small and large towns in Michigan is followed. Heretofore the most that has been attempted in the special lighting of the main business streets of small towns has been the stringing of festoons of small lamps of 4 cp or 8 cp between the regular poles along each curb or across the street. Another plan has been the erection of metal arches across the street, these arches carrying lamps. The plan used in the Michigan towns is both low in first cost, very effective at night and unobtrusive in the daytime. This consists in stretching a span wire from building to building, and suspending from this span wire series tungsten lamps operated from a constant-potential circuit. The lamps are hung at such distances as to form an apparent arch at night, and the street when lighted has the appearance of having a canopy, or roof, over it, with the lamps on this canopy. The illumination produced is both decorative and useful, because there is enough light to facilitate street traffic and attract people to the downtown streets, while the units are small enough and sufficiently distributed to obviate annoying glare.

Design of Car Illumination.

In view of the many perplexing problems that the Association of Car Lighting Engineers had to take up at its recent convention in connection with the electric lighting of steam railroad trains, it is perhaps not surprising that only a small part of the time was given to consideration of car lighting design, or, in other words, to the illuminating engineering of car lighting. Electric lighting of cars has been notably atrocious in most cases in the past, being both uncomfortable for the passengers and inefficient. The discomfort has been caused by the use of bare lamps which could not be avoided by the eyes of the passengers, and the inefficiency has usually been due to the absence of reflectors, faulty placing of lamps, or the improper design of fixtures where reflectors were employed. The problem of illuminating a car is somewhat similar to that of any long, narrow room where a fairly even distribution of light is desired. Usually it is only feasible to place lamps in the ordinary day coach along the center of the deck where the gas and oil lamps have been placed for years, or over each row of seats. Either plan will give good results if the lamps are spaced at sufficiently frequent intervals, and if the proper reflecting and diffusing glassware is used. In general, it is desirable to have one lamp over every other seat and no greater linear distance between lamps than this in the case of center deck lighting. With lamps over the seats, concentrating reflectors should be used, and for the comfort of the passengers, as well as for purposes of reflection, these should be deep enough to cover the lamp. If lamps are in the center, reflectors giving an even distribution of light over an area within 45 deg. from the vertical should be used. If other than deep, concentrating reflectors are used over the seats, too much light will be wasted on the dark sides of the car. There is probably no general class of work where the selection of the proper reflector is more necessary to efficient results than in car lighting, for the reason that the finish of cars is usually so dark. Without reflectors there is, therefore, an excessive loss of light by absorption. It is also possible, even with reflectors, to lose considerable light by absorption on the sides of the car if they are not of a design which confines the greater part of the flux of light to the plane it is desired to illuminate for reading purposes.

Work of the Recent International Electrical Conferences in London.

In October last, two official international electrical conferences were held in London, the actions of which are of considerable interest both to physicists and to electrical engineers. It will be remembered that when the International Electrical Congress of St. Louis convened in 1904, two resolutions were adopted by the chamber of government delegates—namely, first that in view of certain outstanding differences between the legalized electric units in different countries, an international commission should be appointed by the various governments to bring the electric units into conformity; and, second, that by the co-operation of the technical societies of the world, a representative international commission should be appointed to consider the standardization of nomenclature and ratings of electrical machinery and apparatus. The first commission was to be essentially a governmental representation from the various physical laboratories, for the purpose of establishing the same standards of the ohm, volt and ampere in all parts of the world, and to deal with other questions requiring governmental action. The second commission was to be essentially a representation from the various national engineering societies, for the purpose of bringing about an international conformity of ratings and standards of electrical machinery. The considerations before the first commission were to be units and their legalized concrete representation. The considerations before the second commission were to be the properties and classification of machines. The commissions, as above recommended, were called into existence. A number of countries appointed local national committees in connection with the engineering commission; while the principal countries also took cognizance of the physical commission, through the officials of their various national physical laboratories.

The first convention of the engineering commission took place in London in 1906, for organization. Recently—in October last—a convention was called in London of both commissions, except that the engineering commission held only what was called a council meeting, as distinguished from a full convention. It was an unfortunate selection as to dates. The two conventions would better have been held at distinctly different times, if only because one is properly a convention of physicists from national laboratories, while the other is properly a convention of engineers. Nevertheless, many countries appointed eminent physicists to both commissions, and, in most cases, the same delegates appeared at both meetings, partly to avoid the complication and expense of separate national delegations. It ap-

pears, however, that the American Institute of Electrical Engineers was not represented at the engineering meeting by official delegates. Another point that may be noted in this connection is that each country had been requested to appoint a sub-committee to formulate the work to be brought before the meeting, but when the British sub-committee some months later had issued its report in pamphlet form, the American sub-committee had not yet been named. As the organization of the two commissions as a substitute for the former Chamber of Delegates of international electrical congresses was the result of an American proposition, it is unfortunate that this country, so far as relates to the electrical engineering commission, has thus far neglected its opportunity to be a factor in the work of that body, which only meets at intervals of two years. The result of thus mingling the affairs of the two commissions was an impairment of efficiency in both, but particularly in the engineering commission. Nevertheless, advance has been made in the work of both commissions. The goals of uniformity in the various national standards of resistance, voltage and current on the one hand, and the goal of uniform machinery ratings, so that machinery shall be classified, tested, and rated alike in different countries, are nearer and clearer to view by reason of these two conferences, than before, in spite of some confusion and inco-ordination. We may well hope that each succeeding conference will develop greater effectiveness and better mutual understanding of local conditions.

As regards the convention on units, which was held first, the convention indorsed the C. G. S. system of units, and defined two concrete methods of establishing the fundamental standards—namely, (1) the ohm, by a certain laboratory process of producing a mercury ohm virtually 106.3 cm. long and 1 sq. mm in cross-section at 0 deg. C.; and (2) the ampere, by a certain laboratory process of depositing silver in a silver volt-ammeter. This finally makes the standard volt a secondary standard, dependent on the ohm and ampere, a matter over which there has long been a difference of opinion. There was much active discussion over the length of the mercury column for the standard ohm, the length 106.300 cm being finally voted. Some criticism has attached to the seemingly elaborate addition of the two zeros, and the conference has been alluded to jocosely as the "conference of the two zeros." However, there can be no doubt that the various national laboratories will understand each other the better for the conference, and that, in future, the standards of the ohm, volt and ampere kept on delivery at the national physical laboratories, will thereby be the more nearly in unison. From an engineering standpoint, this international agreement on units is much more important than a very high degree of precision in some country or countries, together with appreciable variations between the Reichsanstalt, Paris, Kew and Washington volts, ohms and amperes.

In considering the engineering commission—or "International Electrotechnical Commission"—the first act, after the address of welcome, was the election of Prof. Elihu Thomson as the president, to succeed Lord Kelvin. The late Mascart would have succeeded Lord Kelvin if he had lived. The election of Professor Thomson will be a matter for general congratulation. Several minor amendments were adopted in the rules of the commission, which are practically its by-laws. Certain resolutions were adopted as to nomenclature of electrical machinery and apparatus. It is evident that in order to arrive at international rules governing the classification, rating and testing of machinery, the terms used must be defined and understood, so that an international classification of terms and their definitions is called for. At the same time, we think that the less of this international glossary the better, for the sake of simplicity. The number of terms standardized should be made as small as the main purpose of the committee will permit. Otherwise, the efforts of the commission are likely to be deflected from the main purpose of classifying machines to the minor and incidental purpose of classifying words. The French proposal of an international candle as an effective compromise between the luminous intensity standards of England, France, Italy, the United States and other countries was considered, but was not acted upon. This inaction will be regretted by workers in the United States, at least. If the international candle could have been adopted, it would have simplified technical literature and comparative photometry to a great degree. It is much to be regretted that a strong American delegation was not present to advocate the adoption of standardized incandescent lamps for concrete candle-power standards, which matter it was hoped would be brought before the commission for action. However, we may hope that action has been only deferred to become more effective when taken.

A very important resolution was carried in regard to the metric system. It was agreed that when the commission has to make use of measurements, the metric or C. G. S. system shall be used; but that for the needs of countries not using the metric system, the local national committees shall have the right to add, in parentheses, the local equivalent values. This metric system action is the first piece of truly constructive work done by the commission, and if all the rest of its work were omitted, this action alone would justify the labor and expense of organizing the commission. It is only through the medium of the metric system that international electrotechnical unification progress can be hoped for, and we heartily congratulate the conference on the recognition and establishment of this principle. Finally, the German delegates stated that if it was thought desirable to convene the full commission in 1910, the German committee would be glad if Berlin should be selected as the place of meeting. The general good-will manifested at the commission augurs well for the future success of the movement for which the commission has been appointed. There can be no doubt that an electrical machine, or piece of apparatus, ought to have one and the same rating and classification all over the world, its properties depending on physical laws that are alike in every country. It only needs good-will and mutual understanding to arrive at a uniform system of testing, rating and classifying machines, irrespective of the latitude and longitude of the places where they are made or used. In fact, already, the differences between national usage in these respects are small by comparison with the agreements. It is most sincerely to be hoped that in the future work of the commission our country will become a factor, both with respect to propositions to be presented for action, and the appointment of a carefully-selected official delegation to represent the American electrical engineering profession and industry. To this and similar higher professional work, the American Institute of Electrical Engineers might well sacrifice some of its university extension activity.

New York Commission Upholds the Ten-Cent Fare.

The Public Service Commission of the First District of New York on Dec. 12 dismissed the complaint of the Flushing Association against the Brooklyn Heights Railroad in regard to the exaction of a 10-cent fare between Park Row, New York, and Flushing. The opinion was written by Commissioner Bassett and says that the 10-cent fare is neither illegal nor unreasonable.

The complainant alleged that the company charged a second fare of five cents to passengers traveling in each direction between Ridgewood and Flushing, and maintained that such extra charge is illegal and in violation of the terms of the company's charter. In its answer, the company denied the allegation of illegality and maintained that its franchises expressly authorize a fare of at least 10 cents, that such fare is reasonable and that a reduction would involve such a loss as to be confiscatory.

The opinion of the commission says: "The fact that one may ride 20 miles for a single fare results from the elaborate system of transfers, some of which are made mandatory by the railroad law and some a voluntary arrangement between distinct though affiliated companies of the Brooklyn Rapid Transit system. The fact that combinations of these compulsory and voluntary transfers make possible a ride of 20 miles for five cents, does not in itself constitute a sufficient legal reason why the Flushing-Ridgewood line should be operated to its terminus for five cents. The evidence shows that the Long Island Railroad station is within a stone's throw from the terminus of the defendant's line at Flushing and that in the morning rush hours the steam railroad platform is covered with people waiting to go to Manhattan by the steam trains at 20 cents fare, while the defendant's trolley cars start out from the same point not more than one-half filled. It is therefore apparent that one reason why people do not travel more on the defendant's cars is because of the long time consumed in proceeding the 12 miles to the Brooklyn Bridge. There is no reason to believe that a reduction of fare would cause such an increase of business as would wipe out the deficit."

Investigation of New York City Central-Station Companies.

A final hearing took place before the New York Public Service Commission, First District, on Dec. 3 in relation to proposed order No. 823, relating to the publication of rates and deviation therefrom.

Mr. Charles F. Mathewson, New York & Queens Electric Light & Power Company, said that counsel for the companies had had interviews with the operating officials and prepared amendments which they would like to suggest. He said that if the companies and the commission were unable to reach a form of order which the companies thought just, they retained the right to object to the order on the ground of jurisdiction or any other ground, but hoped that it would not be necessary to follow such a course.

He presented a list of suggestions, and in discussing then said he did not know of any public service corporation, railroad or other, which was obliged to file at any time more than the schedule of rates. In deference to the suggestion of the commission, the electrical corporations, however, were willing to post for the convenience of prospective consumers not only copies of the schedule of rates, but of every contract blank and rider, so that a selection might be made. Mr. Mathewson did not know of any public service corporation law in any State requiring so much as that, and certainly there was no provision anywhere requiring the filing of non-essential provisions, like an agreement to read a meter on a certain date. The number of services installed for a consumer protected the company fully as much as the customer.

Mr. Mathewson believed that the changes suggested by the companies would meet all requirements. If it should be found in the future that the requirements of the commission were not met, that situation might be taken up and a further order issued. The companies asked the commission, however, to see if the changes suggested by them did not effect the result required. Among other changes desired by the companies was the omission of the section providing that each corporation should provide and maintain a sufficient supply of the current schedules and supplements at every office to meet promptly any reasonable demand therefor by a customer or prospective applicant for service. Objection was raised to this section on account of the expense and confusion which it would entail.

Commissioner Maltbie said that that point was considered when the order was drawn, but it was thought that the schedules would probably be so brief that the expense would not be great, while the schedules would be of value to the consumers.

Another change suggested was to have the schedule, where a change reduced the rate, take effect as soon as a copy should be filed with the commission and posted. Where competition arose that provision would allow the company to reduce its rate in order to meet a competition, without application to the commission.

Another change suggested was in the verification clause. Mr. Mathewson contended that the verification as drawn in the form of order submitted by the commission was much more stringent than was usual in documents of the kind. Commissioner Maltbie thought that the verification clause was substantially the same as in the case of railroad schedules used by the New York State commissions.

Mr. Mathewson said that the electric schedule involved other points than rates. It seemed to him that if an official swore that the schedule was true to the best of his knowledge and belief, that ought to meet all requirements. If the commission should find that the officials of the companies were so loose in statements that they ought to be restricted further, another order could be posted. Commissioner Maltbie said he had had before him within a few days a case where an officer of a company made a sworn statement to the State department and was unable to verify any portion of it except his signature.

Mr. J. E. Phillips, Richmond Light & Railroad Company, submitted a proposed substitute for the form of the order. He added that Mr. Adrian H. Larkin, representing the company, wanted the right to file a memorandum as to the power of the commission.

Mr. J. W. Lieb, Jr., associate general manager, New York Edison Company, said that company would concur in the suggestions as to amendments that had been presented by Mr. Mathewson, and would also concur in general as to the reasons presented by Mr. Mathewson in regard to the modifications and their necessity in the practical application of such an order.

Mr. E. D. Hawkins, Queensboro Gas & Electric Company, protested against the proposed order on the ground that in form and substance it was unauthorized, either by the statute under which the commission is acting or by law. In his opinion, there was no authority in the statute or law to compel the companies in this way to keep open to public inspection their printed schedules of rates or contracts, or conditions of supply and regulations relating to the service of such electrical corporations in the manner in which the proposed order provided. Reserving such rights as the company had and for the purpose of meeting the suggestion of Commissioner Maltbie as to amendments, Mr. Hawkins suggested that the proposed order consist of one section stating that every electrical corporation subject to the jurisdiction of the commission should file with the commission and keep open to public inspection printed schedules of all rates. Mr. Hawkins also filed amendments to the order as suggested by the commission.

Mr. W. W. Freeman, Edison Electric Illuminating Company, of Brooklyn, submitted a proposed schedule, and Mr. Frank W. Smith, secretary, United Light & Power Company, asked for the modifications proposed by Mr. Mathewson.

Commissioner Maltbie then declared the hearing closed.

Gasoline Car for New York City.

The Third Avenue Railroad Company of New York, which is now in the hands of Frederick Whittridge, receiver, is having built at the shops of the General Electric Company at Schenectady a gasoline motor car of the type used by Western railroads for suburban service, which it will test upon its line. The car will be electrically operated, the current being generated inside the car by a gas engine. Such a service is an innovation in street railway practice, and naturally is in the nature of an experiment.

Independent Telephony in Chicago.

President C. H. Moulton and General Counsel H. D. Critchfield, of the International Independent Telephone Association, appeared before the gas, oil and electric light committee of the Chicago City Council Thursday, Dec. 10, and submitted two distinct propositions, the adoption of either one of which will allow the independent telephone companies to have communication with the residents of Chicago. The first proposition submitted requested that the committee aid the telephone companies in completing a deal whereby the properties of the Illinois Tunnel Company could be turned over to the independent telephone companies at a fair valuation. If such a proposition could be effected it was stated the independent companies would bind themselves to spend any part of $20,000,000 which might be necessary in bringing the deal to a successful close. The second proposition submitted was in effect that the independent companies would consummate a contract with the Illinois Tunnel Company, providing the tunnel company would agree to establish within two years a system of at least 20,000 telephones within the city of Chicago. No definite action was taken on the propositions submitted.

Moonlight Tables for 1909.

With this issue we place before our readers the "Moonlight Schedules" for 1909, prepared for ELECTRICAL WORLD by Mr. Henry W. Frund, being the twenty-second annual publication of this useful compilation. As was pointed out by Mr. Frund last year, these schedules differ from others in vogue, particularly what is usually called "The Philadelphia Moonlight Schedule," whose rule is, "Light one-half hour after sunset and one hour before moonset. Extinguish one hour after moonrise and one hour before sunrise."

There are at least seven standard schedules with 152 variations, and there are certainly more than that extreme number of changes on which city contracts are based, a fact often forgotten by people who quote rates from one city to apply in arguments elsewhere.

The salient feature that has made Mr. Frund's "Table No. 1" popular and extensively used is the fact that it is practically an every and all night schedule at 3000 hours per annum against all night at 4000 hours per annum. Table No. 2 practically made void the Philadelphia table by giving more lighting hours before midnight and dispensing with lighting after midnight, especially on the three nights immediately before full moon; making an approximate difference of 200 hours per annum, counting the Philadelphia table at 2200 hours per annum, and No. 2 table at 2000 hours per annum.

The lighting schedules for 1909 are based on mean local time as given in the calendar for 1909, and are calculated for latitude 40 deg. north, being nearly that of Philadelphia, and adapted to the following cities and states: New Jersey, Delaware, Maryland, West Virginia, Pennsylvania, Kentucky, Ohio, Indiana, Illinois, Missouri, Kansas, Denver, Colo.; Salt Lake City, Utah; Carson City, Nev., and Tehama, Cal. For adjoining states north or south of above the error may be 10 minutes, to be added or reduced from time given for lighting or extinguishing by this schedule.

It should be noted that in towns where standard (railroad) time is used, proper deductions or additions must be made. The schedules are grouped on the form of a supplement to this issue of the paper for regular and more convenient reference.

Hartford Street Lighting Situation.

Dr. Louis Bell, of Boston, consulting engineer for the city of Hartford, Conn., has submitted a report to the street lighting committee on the proposals recently offered for street lighting by the Hartford Electric Light Company and the Hartford City Gas Light Company. The report states that the Hartford Electric Light Company proposes the consideration of three systems: First, the present arc system; second, the use of two types of modern incandescent lamps not properly specified in the proposal, and, third, a system of modern arc lights, giving about double the light of the existing arc lamps, the energy to be furnished at these arc lamps not being specified. Neither the candle-power nor the energy to be supplied is stated in the case of the incandescent lamps proposed. The Hartford City Gas Light Company offers bids for both gas and electric lighting, the latter being by arc and incandescent lamps. Dr. Bell states that the bid for gas lamps, without reflecting on the merits of the system, should be rejected on the question of price, the figure quoted for a 60-cp gas lamp being considerably higher than the quotation of the same company for a 100-cp electric lamp. The electric bid of the Hartford City Gas Company covers, first, a modern arc light of which the type is specified without any definite statement as to the energy to be supplied to the lamp or of the rated or actual candle-power to be delivered, and, second, there is offered a 100-cp tungsten incandescent lamp.

In his report Dr. Bell points out that he believes both companies are acting in good faith and that either could furnish suitable lighting to the city in response to a suitable specification. Under the circumstances it is recommended that new proposals be called for, and the board of contract and supply at the request of the street commissioners has rejected all bids for lighting and advertised for new bids which are to be opened Jan. 4, 1909. In general the new bids are to provide for lights operated from dusk to dawn every night in the year on a schedule amounting to approximately 4000 hours per year. The lamps for service with which bids are requested are titanium-type are taking not less than 4 amp and 300 watts at the arc; magnetite arc lamps of the same current and energy limit; tungsten incandescent lamps taking substantially 250 watts at the terminals and operating at a specific consumption of about 1.25 watts per candle; 125-watt and 75-, 50- and 40-watt tungstens of the same efficiency. Prices may be quoted on other lamps, provided full particulars are given. The number of arcs required will not be less than 400, and the number of incandescents not less than 1000.

Proposed Increase of Duty on Mica.

The following table, from a publication of the U. S. Geological Survey, gives for the past three years the domestic production and value of mica and also the importations of the material and their value. The United States consumption can be assumed to be the total of the mica produced and imported:

	Produced in United States.		Imported.	
	Pounds.	Value.	Pounds.	Value.
1905.....	924,875	$160,732	1,188,449	$296,362
1906.....	1,423,100	252,248	2,412,261	731,488
1907.....	1,060,182	349,311	3,448,452	1,295,606

As amber mica is produced only in the Provinces of Quebec and Ontario there seems to be at present no opposition to the claim that it should be admitted with little or no duty. There is, however, a movement on foot to increase the duty on white mica, which grade is chiefly produced in India and divided into commercial sizes as follows:

No. 6, having an area of 1 to 3 square inches
No. 5, " " " " 3 " 6 " "
No. 4, " " " " 6 " 10 " "
No. 3, " " " " 10 " 16 " "
No. 2, " " " " 16 " 25 " "
No. 1, " " " " 25 " " and over

The present duty (6 cents per pound and 20 per cent ad valorem) was imposed when the smaller sizes of mica were not used. Now, however, that the very small sizes are used the duty on these varies from 50 per cent to 150 per cent under the present law as compared with 25 per cent or less upon the larger sizes.

From the table above given it will be seen that the production of mica in the United States in the year 1907, when the price was approximately double that of the year 1905, exceeded the 1905 production by only 15 per cent. On the other hand, the increase in price of about 60 per cent led to an increase in importations of nearly 300 per cent. These figures indicate what is otherwise well known—that the mica deposits in the United States are not of a kind to displace the use of imported mica for electrical purposes.

It is proposed to increase the duty on white mica to 12 cents per pound and 40 per cent ad valorem in order to further the American mica industry. In other words, a specific duty of $240 per ton and an ad valorem duty of 40 per cent are asked, though the specific duty alone would equal or exceed the present value of the smaller sizes of mica imported. The amount of labor employed in mica mining in this country, even when the largest production has existed, is insignificant. Probably at no time has the number of men engaged in mining exceeded 1000, and the number is usually much smaller. The number of people, however, affected by the duty and who would pay the enormous tax proposed is great and consists largely of manufacturers of electrical apparatus and users of electrical current. Instead of any increase of duty, a lowering of the tariff on the smaller sizes of mica appears to be called for.

Motor-Starter Patent Suit.

On Dec. 15 the United States Circuit Court of Apeals at New York gave a hearing on a patent suit brought by Mr. H. Ward Leonard against the Cutler-Hammer Company and Richard H. Mansfield, Jr. This case represents an appeal from the final decree of the United States Circuit Court of the Southern District of New York dismissing a bill of complaint of an action in equity for infringement of patents for an injunction and an accounting. The patents involved are No. 673,274, issued to H. Ward Leonard on April 30, 1901, and No. 668,140, issued to Mr. H. H. Cutler on Feb. 12, 1901. The patents relate to what is known as a double-break controller involving an overload circuit-breaker and a no-voltage release, the arrangement being such as to overcome previous difficulties which had been encountered in hand-starters for shunt-wound motors. The appellee claimed that the lower court had erred in its conclusion that it was an obvious thing to do what Leonard did at the time he did it.

Mr. Leonard was represented by Mr. William Houston Kenyon, while the Cutler-Hammer Manufacturing Company and Richard H. Mansfield, Jr., the appellant, were represented by Mr. Charles Neave. Mr. Kenyon stated that while an overload circuit-opening device had been combined with a no-voltage release device according to the early Fisk patent, the combination had not been satisfactory, and the device produced by Leonard represented a great improvement in that certain difficulties encountered during the starting period and under overload were overcome. Mr. Neave said that the patents upon which the suit had been brought related merely to the use of an overload device with a no-voltage release and that any improvement due to the mechanical interconnection of these two devices was not covered in the patent. The judges in the case are Messrs. Lacombe, Cox and Noyes. At the time of going to press the judges had not rendered their decision.

New Electrical Engineering Societies.

As recently announced in these columns, a new association will shortly be organized having for its object to cover all subjects relating to the use of motors on central-station circuits. It is understood that an effort will be made to connect this body with the National Electric Light Association. A movement is also under way to form an association having for its membership electrical engineers in charge of the electrical plants of large industrial works, in this respect being similar to, but broader in scope than, the recently founded Association of Iron and Steel Electrical Engineers. Two recently founded professional bodies are the Society of Wireless Telegraph Engineers and the Association of Car Lighting Engineers. While the latter is not professedly an electrical organization, its first meeting indicated that it will deal largely or entirely with electric car lighting. Though not electrical in character, it is interesting to note that the formation of a Society of Gas Engine Engineers is now being agitated.

Operation of the New Haven Electrical Equipment.

At the meeting of the American Institute of Electrical Engineers, Mr. W. S. Murray, electrical engineer of the New York, New Haven & Hartford Railroad Company, read a paper discussing in considerable detail the operation of the electrical equipment of the road since its installation. The paper contained a full account of the train-minute delays during the months of July, August, September and October, 1908, and indicated a cause for each delay. It also contained a daily report of the operation of locomotives during the same months, together with a report of the distance covered by each locomotive on Sept. 5—Labor Day. The author stated that after certain faults had been overcome electric service proved to be much more satisfactory and reliable than the previous steam service had been.

Mr. Murray discussed the changes that have been made in the power-house equipment, the overhead circuits and the locomotives. Shortly after the equipment was placed in operation it was found that the utilization of single-phase current for railway purposes from the three-phase star-wound generators produced a stray magnetic field completely out of the path of normal lamination. As a result it was impossible to develop for continued operation more than 66 per cent of the normal rating of the generators, although the generators were guaranteed to carry 50 per cent overload for two hours. The difficulty due to the stray field was cured by surrounding the rotating field member of the generator with short-circuited winding similar to that used in the well-known squirrel-cage type of induction motors. The generators are to-day operating so as to fulfill the manufacturers' guarantee. The insulation on the overhead catenary trolley system proved inadequate and it was found necessary to increase by 100 per cent the anchor insulators and to add wood stick insulators in series with the molded material insulator between the pull-off wire and pull-off post. Porcelain insulation was substituted for the molded material used on the anchor bridge switches.

A considerable number of the delays were due to failures of circuit-breakers either in the power house or on the line. The difficulty was overcome by feeding energy into the line through the impedance coils installed in leads of the generators instead of using a direct transmission from the power house busbars to the trolleys. The impedance coils act as shock absorbers, thus protecting the generators, and they also limit the current which the circuit-breakers must interrupt under short-circuit conditions.

Experience showed that satisfactory results could not be obtained with a rigid contact wire. A remedy was found in suspending an auxiliary wire from the originally installed copper wire by clips at mid points between the hangers. The auxiliary wire is made of No. 4-0 grooved steel. Mr. Murray stated that the New Haven road had been operating with the auxiliary wire for several months and absolutely no kinking has been noted at the hanger points, and the result has been a smooth and almost sparkless overhead contact.

A short experience in the commercial operation of the locomo-

tives proved two important facts. The first was that the two main parts of the locomotive—namely, the transformer and motors—had sufficient capacity to more than handle the manufacturers' guarantee. The second was the discovery that many of the auxiliary electrical and mechanical parts of the locomotive equipment were not of equivalent capacity. Numerous changes were made in the auxiliary locomotive equipment, the most important electrical ones being in the switch groups and brush holders of the motors; the former lacked carrying capacity and the latter had insufficient insulation. The most important mechanical changes necessary were reinforcement of the truck bolsters and the installation of pony wheels.

The author called attention to a point in the design of the locomotives which he stated had been persistently misrepresented by those ignorant of the facts. Coincident with the use of the first double-unit locomotive there was started a rumor that the locomotives had proved too weak for the service. As a matter of fact each locomotive unit was built for a trailing load of 200 tons, the intention being to use one unit for about 75 per cent of the trains and two units for the other heavier trains. He gave a list of trailing loads pulled by the locomotives during a certain week, showing that a single unit actually hauled a trailing load as heavy as 400 tons, while a double-unit locomotive pulled a trailing load of 853 tons.

In discussing his conclusions with reference to the operation of the electrical equipment Mr. Murray remarked he was in favor of electrification three years ago, but at present, standing on the more stable ground of experience, particularly in regard to the department of faults, he is doubly in favor of it.

DISCUSSION.

The discussion was opened by Mr. Calvert Townley, upon whom had fallen the responsibility of selecting the form of equipment when the installation was first made. Mr. Townley complimented Mr. Murray on the confidence in the New Haven equipment which permitted him to exploit its blemishes while feeling sure that its beauties would be properly appreciated without having attention drawn to them. He stated that many of the minor troubles which had been encountered would have been overcome, and very many of the defects which caused delay to service would have been detected in advance if sufficient time had been allowed for development. Mr. Townley said that the operation during the "trying-out" period needs no apology, the delays due to the line and locomotives having been less than he had anticipated.

Mr. W. J. Wilgus expressed the opinion that the experimental application of the electrical apparatus under untried conditions properly belongs to unimportant localities where the results of failure will not be burdensome, and that only the most reliable well-tried methods should be used where the results of failure may be embarrassing.

Mr. B. G. Lamme, of the Westinghouse Electric & Manufacturing Company, stated that he had given a great deal of his personal attention to the design of the main motors on the locomotives and the alternators in the power house. He stated that each of the 164 motors used by the New Haven system has averaged slightly over 40,000 miles of travel since being put in operation. The commutators of these motors are to-day in first-class shape, having a good polish and showing relatively little wear. In no case has the commutator been turned, and none of them has ever been sandpapered while in service. At the present rate of wear on these commutators there appears to be at least 15 years of life in each one of them. There is relatively little sparking even when developing 2½ times full-load torque. Examinations of the condition of the windings on the armature have shown that there has been no dangerous overheating, and the preventive resistance leads exhibit no evidence of over-heating. As a matter of fact, the records for the preventive resistance leads is even better than that for the main coils themselves, the leads having proved to be one of the most durable parts of the equipment.

Mr. Lamme stated that there did not develop in the generators any defect which was not to a certain extent foreseen and apparently provided for. The existence of the pulsating armature reaction in single-phase generators was well known. It was believed that the difficulty due to this pulsating could be overcome by laminating the field poles. However, in the case of high-speed turbo-generators of large output it is almost impossible to laminate everything completely, due to the fact that the mechanical requirements called for rigidity in some of the structural details. Experience showed that when laminations were substituted for solid poles the overheating was not decreased, but was actually increased because the solid poles acted as dampers, thus doing away with part of the pulsation.

The result was therefore that the very act of using lamination to avoid the trouble caused the trouble to be greater. A complete cure was found in putting on the rotor a short-circuited winding of such a size that a large current could exist in it with very little loss. The last machine built, which is rated at 4260 kv-amp at single-phase load, has a solid steel field-core in the surface of which the copper cage-winding is imbedded. The test showed that when the cage-winding was used the short-circuit current of the generator was 5000 amp, which was about 15 times the normal full-load current, so that the force on the windings of the armature, which varies as a square of the current, became 225 times the normal value. This difficulty was overcome by installing a complete bracing system for the end windings and by inserting reactance coils in series with the generator leads.

Mr. L. B. Stillwell expressed the opinion that railway electrification during the next 10 years will not be limited to terminals and suburban operation within narrowly restricted zones, and that the decision of the New Haven to adopt a system applicable not only to terminals, but also to trunk-line operations and the frank report of results attained should powerfully assist in the prompt evolution of that system which is fittest and therefore best to survive. The New Haven installation opened the door to possibilities of electrification of railways with its demonstrated improvement of service and economy of operation over zones far beyond the reach of the 600-volt, direct-current system. So far as four months' operation may be taken as an indication there is nothing in the record which is discouraging as regards the electrical equipment of the locomotives. Mr. Stillwell stated that if Mr. Murray will supplement his paper six months later by a contribution giving the log of operation during the coming winter, and if someone representing the New York Central will supply similar information, further conclusions of importance can be drawn.

Mr. A. H. Armstrong, of the General Electric Company, remarked that Mr. Murray is entitled to the greatest praise for the frank presentation of his paper. Enthusiastic co-operation of the engineers of the railway company and the manufacturing company has brought the alternating-current installation to an engineering success and nothing but admiration can be expressed for the courage and ingenuity shown in overcoming the difficulties encountered in operation. Mr. Armstrong said that although the New Haven alternating-current locomotive is somewhat heavier than the New York Central direct-current locomotive, it is guaranteed to handle a trailing load of only 200 tons as compared with 400 tons for the latter locomotive. He gave a list of delays in the New York Central service during the months of July, August, September and October, 1908. During these four months the total train-minute delay was 160 as compared with 5695 for the New Haven service.

Mr. N. W. Storer, of the Westinghouse Electric & Manufacturing Company, presented some interesting curves showing that the tractive effort at the one-hour rating for the New York Central locomotive is slightly more than double that of the New Haven locomotive. However, owing to the forced ventilation on the New Haven locomotive its continuous capacity both in speed and in tractive effort is higher than that of the New York Central. This fact indicates that the New Haven locomotive would handle about the same weight of trains in express service as the New York Central where the service is sufficiently continuous for the latter to get warmed up. He remarked that the New York Central locomotives have thus

far been used only in switching service, and have not been subjected to express service.

Mr. E. B. Katte, of the New York Central Railroad, explained that two of the delays attributed by Mr. Murray to failures of supply of energy throughout the direct-current zone were due to damage to the third-rail. At no time has there ever been a lack of supply for the third-rail when this rail was in condition for use.

Mr. C. L. DeMuralt expressed the opinion that "the New Haven failure is one of the most serious disasters that the electrical engineering profession has suffered for some time."

Mr. W. M. McClellan said that the men connected with the New Haven road have done a great deal for the engineering profession in carrying the installation forward. The information now available will allow the equipment to be duplicated at a satisfactory cost.

Dr. C. P. Steinmetz expressed his gratification at the verification by actual experience of the theoretical conclusions derived by unbiased engineers that heavy railway work can be handled by single-phase motors. He said that the record of the operation of the New Haven equipment establishes the single-phase motor as one of the means by which the future electrification of the country's railroad systems will take place.

The Gas Engine in the Small Central Station.

At a regular meeting of the Worcester Polytechnic branch of the American Institute of Electrical Engineers, on Dec. 11, an address was given by Mr. Fred W. Sawyer, of Boston, consulting engineer, on "The Gas Engine in the Small Central Station." Mr. Sawyer handled the subject in a frank manner, discussing the present status of this motive power with respect to stations of moderate and small capacity.

The gas engine, he said, clearly has the advantage, even in the small station, in any natural gas district. Here the investment is limited to the engine, the gas being clean, cheap and satisfactory. A fair price for good natural gas in the Indiana and West Virginia fields is from 15 cents to 30 cents per 1000 cu. ft. Another place where the gas engine fits in well is in connection with a coal gas plant. The investment here does not greatly exceed the engine cost, and there may be a decided economy in making gas. If holder gas can be produced at, say, 50 cents per 1000 ft., the cost can be cut possibly to 40 cents in the holder through electrical utilization.

To the central-station manager reliability is the feature of the greatest importance in the operating problem. A generating cost that is proportional to even 8 lb. of coal per kw-hour is preferable to irregular service. In one small plant which was improved and made more reliable, the income was increased from $7,000 to $40,000 per year in seven years, largely through the increased reliability of the service. Mr. Sawyer stated that the producer is not yet as reliable as the gas engine, but the pressure type seems to be giving better results than the suction type. The latter form of producer tends to give gas with variable calorific power, often running from 105 to 150 B.t.u. per cubic foot in range. With the pressure type the use of a small holder permits the mixture of the gases, making the product more uniform.

With the gas engine in the small central station the effect of a poor load factor is to reduce the economy greatly. The actual running costs on the basis of the fuel consumed, with good load factor, will average about one-half those of the compound reciprocating engine plant of the same size. It is a mistake to assume that a producer will consume no coal while it is standing still and not working. Some fuel is required for blowing up and getting ready to put gas into the holder, and some lean gas has to be wasted. In actual practice there are nearly as large standby losses as with the banked steam boiler. The gas engine requires a cheaper grade of oil than the steam engine, but the quantity in the former case is somewhat greater, making the lubrication cost a little lower in the case of steam. The repairs on the gas engine are larger, since the valve motion involves cams, with spring returns which may rapidly lose their temper on account of the proximity of the springs to the hot parts of the engine. Valves have to be ground at least once a month and the engine must be wiped out and cleaned frequently. The great trouble is that minor defects will stop a gas engine in comparison with the defects which do not shut down a steam engine. The maintenance of the producer is often high on account of the action of sulphur in the hot gases on the piping and fittings between the producer and the scrubbers.

A serious question at present is the excessive cost of gas engines compared with steam-plant equipment. If a steam plant can be built for $110 a kilowatt, an equivalent gas plant will cost about $150. The gas engine is necessarily heavy, and built for excessive strains which occur during back firing and other emergency conditions, and the weight per horse-power is much larger than with the steam engine. The cost of the producer is about the same as that of the steam boiler; foundations cost more with gas, and the piping costs less. It is doubtful if enough is allowed in figuring the interest charges of such plants, considering the cost of development and financial arrangements which frequently are necessary to establish the station on a firm basis. The depreciation in the case of the gas engine should also be figured well up toward 8 or 10 per cent at least, to allow not only for the deterioration of the plant, but for the possible early replacement of it by more improved apparatus. It does not pay to halve the coal bill and double the interest account, particularly in a small station. It is difficult to compare interest charges and depreciation on a steam and a gas plant on the same basis, as the steam plant will easily carry 50 per cent overload for a long period, while 10 or 15 per cent is the best that can be secured from a gas engine. In the small gas plant the labor cost is generally considerably less than in the steam station of about the same capacity. Thus, in one recent 135-kw engine and producer installation, one man handled the whole station, shoveling but from 250 lb. to 300 lb. of coal per hour. The great difficulty is the question of securing good gas engineers. Troubles must be anticipated more than in the steam plant.

Mr. Sawyer stated that in his opinion there is a large field for the use of combined steam and gas plants carrying the average load on the gas engine equipment and the peaks on the steam end of the station. One can afford to install a cheaper and less efficient steam plant if it is to work only from two to four hours per day, generating at, say, 6 lb. or 7 lb. per kw-hour. Sometimes good economy can be obtained through a second-hand plant, as in one recent case where the fuel consumption is only 4.5 lb. per kw-hour.

In conclusion Mr. Sawyer emphasized the heat thrown away in the jacket water of the gas engine. This has to run between about 140 deg. Fahr. and 150 deg. Fahr. to give proper lubrication at the upper temperature and to give efficient engine operation at the lower temperature. The exhaust gases have a fair average temperature of 900 deg. Fahr. It ought to be feasible to heat the jacket water for use as boiler feed water with these heat units in a combined small gas and steam plant, and thus get rid of banking the boiler fires by using the gas engine waste products. Mr. Sawyer stated that the gas engine has its field, and with improvements and reductions in cost will doubtless take its place as the best prime mover for the small central station.

Physics and Physiology in Illuminating Engineering.

At the meeting of the New York Section of the Illuminating Engineering Society, held on Dec. 10, Dr. C. P. Steinmetz delivered an address with the title "Illumination and Illuminating Engineering." The lecture was devoted largely to a discussion of the relation of illumination to physics and physiology. Dr. Steinmetz outlined the requirements for satisfactory illumination and explained that of two lighting results which, according to physical measurements, are identical, one may be satisfactory

and the other unsatisfactory due to the difference in physiological effects.

One feature of illumination which has a direct bearing on the physiological effects is the brilliancy of the source of light. When the eye is subject to a lamp at high brilliancy, the pupil contracts so that, although the illumination upon certain objects may be large, as measured by a photometer, the contraction of the pupil causes the eye to recognize the illumination as too low. On account of this fact, when indirect lighting is employed, a lower flux density may be used than when bare lamps are exposed to view.

A physiological fact which must be taken into consideration in the designing of lighting equipments is the demand by the eye for a variation in illumination in order to render objects properly visible and to afford a rest for the eye. The property of the eye known as "fatigue" is an extremely useful one. On account of the adaptability of the eye it is possible to view objects with some satisfaction when the illumination is as low as that produced by the moon or as high as that given by bright sunlight. It is desirable in many instances for the illumination to be non-uniform in order that the eye may receive rest. Thus in the lighting of libraries it is best for the general illumination of the room to be low and for a high flux density to be employed at the reading tables.

Dr. Steinmetz laid particular stress upon the effects upon the eye produced by shadows. He said that when the shadows are either too sharp or not sharp enough the effect is deceiving to the eye. With directed light coming from a point source, the shadows are too sharp, while with well diffused light there are practically no shadows. The most satisfactory result is obtained when the light is such as to produce an effect between the two extremes just mentioned. Such a result is secured when the light comes from a single source of large area, such as a tube lamp or an incandescent lamp within an opalescent globe, or from several sources.

In discussing the lighting of streets, Dr. Steinmetz stated that the present method of using arc lamps placed less than 20 ft. from the surface of the street can be improved by raising the lamps to a height of from 30 ft. to 40 ft. In this way the illumination immediately below the lamps will be decreased considerably, but the illumination half way between the lamps will be altered inappreciably; the lamps will be removed from the field of view and the direction of the shadows will be improved. The sharp shadows produced by an open arc lamp or by an enclosed lamp equipped with a transparent globe can be avoided by the use of an opalescent globe, but when this method is employed the space distribution of the light from the lamp is altered. Better results can be secured by the use of prismatic globes which allow one to eliminate the shadows and yet obtain the desired distribution.

Dr. Steinmetz expressed the opinion that when all of the conditions are properly taken into consideration the lighting of streets in America is equally as satisfactory as that in European cities. In comparing American cities with foreign cities it is necessary to recognize that the density of population per mile is very much greater in Europe than in this country. Hence, an expenditure for lighting which would be permissible in the former would be entirely too great under American conditions.

In the course of his address Dr. Steinmetz entered a plea for the more extended use of the lumen for expressing the output of lamps rather than the candle-power. While the candle-power can be applied with accuracy when dealing with point sources or sources which can be considered as points, it leads to misunderstanding when applied to lamps of the tube type, etc. By the use of lumens for expressing the total flux from a lamp one avoids the ambiguity attending the use of the candle-power.

Meeting of Pittsburg Section, A. I. E. E.

The regular December meeting of the Pittsburgh section of the American Institute of Electrical Engineers was held Dec. 8 in the Carnegie Institute Lecture Hall. Mr. W. Edgar Reed, chairman, presided. The attendance was 110. A preliminary dinner was held just previous to the meeting at which the attendance was 17.

The subject for the evening was "Some Experiences in the Use of Gas Engines for Electric Power Generation," an original paper by Mr. J. R. Bibbins, of the Westinghouse Machine Company. Lantern slides were used to illustrate the paper.

The discussion following the paper was participated in by Prof. W. Trinks, of the Carnegie Technical Schools; Mr. W. E. Moore, of the West Penn Railways Company; Mr. Wm. Hoopes, of the Aluminum Company of America; Mr. C. D. Smith, of the U. S. Geological Survey; Mr. E. B. Tuttle and Mr. R. A. L. Snyder, of the C. D. & P. Telephone Company; Mr. J. G. Schroeder, of the Union Switch & Signal Company; Mr. W. F. Flint and Mr. E. B. McClelland, of the Westinghouse Machine Company, and Mr. P. M. Lincoln, Mr. W. L. Waters and Mr. D. W. Burke, of the Westinghouse Electric & Manufacturing Company.

The subject of "Electric Furnaces" will be discussed at the next meeting, to be held on Jan. 12, at which time an original paper on the subject will be presented by Mr. Wm. Hoopes, of the Aluminum Company of America.

Electrical Engineering at Massachusetts Institute of Technology.

As is well known, the Massachusetts Institute of Technology maintains very strong undergraduate courses in engineering, but it is not so well known that the Institute is attended by what is probably the largest number of graduate students in any of the engineering schools in the country. There are now 215 graduate students studying at the Massachusetts Institute of Technology on whom degrees have been conferred by colleges and engineering schools through the length and breadth of the continent.

A notably large number of the young men studying electrical engineering at the Institute of Technology come from among these graduate students. Many of these students in the electrical engineering course have heretofore pursued a course in Arts or a course in General Science and are spending two or three years in completing the electrical engineering course at the Institute. Others have graduated from other engineering schools and are spending from one to two years in study at the Institute to get its baccalaureate degree in electrical engineering; and a few of particularly high preparation are pursuing advanced study and research for the purpose of obtaining the higher degrees of Master of Science in electrical engineering or Doctor of Engineering.

It is probable that the latter students occupied in advanced study and research are enjoying the first regularly organized work in this country leading to the degree of Doctor of Engineering. That degree has heretofore been conferred by American engineering schools as an honorary distinction, but it has not in this country been recognized among the degrees to be secured by study and research in the schools. Brilliant work has been done by students studying for this degree in the great polytechnic schools at Berlin and Carlsruhe, Germany, and work of this nature at the Massachusetts Institute of Technology bids fair to become popular with students of the highest ability and to be influential in the development of engineering research.

The undergraduate electrical engineering course at the Institute of Technology has a senior class which is 20 per cent larger this year than last year, and the department will soon be a candidate for larger quarters. The laboratory quarters are large and impressive in their equipment, but even they are becoming overcrowded, and additional class rooms are much needed.

The prospects of entering into larger quarters are bright with the advent of the recently elected president, Dr. Richard C. Maclaurin.

Meeting of the Ithaca Section, A. I. E. E.

The regular meeting of the Ithaca section of the American Institute of Electrical Engineers was held on Friday evening, Dec. 11. Prof. H. Wade Hibbard, head of the Railway Mechanical Department of Sibley College, presented a paper on "The Handling of Men," in which he outlined the various features of executive work, and pointed out the essential elements of successful co-operation between employers and employees. He advocated courses of instruction in handling of men for undergraduates in technical schools, and instanced the Charlottenburg Technical High School, of Berlin, as an example.

The paper was followed by a lively discussion, in which particular attention was given to the problem of the treatment of foreign labor in the American shop and factory. In closing the discussion Professor Hibbard paid a high tribute to Italian and other European workmen, and stated they could become very efficient mechanics and excellent workmen if properly understood and managed.

In view of the fact that the local branch of the American Society of Mechanical Engineers was formed on Dec. 10, the following resolution was passed by the Ithaca section of the Institute: *"Resolved,* That the Ithaca section of the American Institute of Electrical Engineers extends to the officers and members of the Cornell University branch of the American Society of Mechanical Engineers, recently formed, best wishes and assurances of hearty co-operation in their work and plans."

Arc-Light Composite Electrode.

A patent granted Dec. 1 to Berthold Monasch, of Berlin, Germany, on an application filed May 16, 1906, describes an arc-light electrode which, it is stated, overcomes the flickering of composite electrodes due to the formation of pools of melted material at the electrode ends. This result is produced by the addition of several per cent of silicon carbon to the materials of the composite electrode, the presence of which insures at all times a covering on the electrode ends of unfused silicon carbide, thereby resulting in a quietly-burning arc.

CURRENT NEWS AND NOTES.

BOSTON MOTOR BOAT SHOW.—A motor boat and engine show will be held in the Mechanics Building, Boston, in the week of Jan. 23-30, 1909.

SOUTHWESTERN ELECTRICAL ASSOCIATION.—The executive committee of the Southwestern Electrical & Gas Association has recently decided to hold the 1909 annual con- of $1,017,965.

ILLUMINATED PARADE.—At the head of a large religious parade in connection with some Episcopal evangelistic services in New York last week, a large cross was carried made up of small incandescent lamps fed from a battery in the rear. The effect was beautiful in the darkness of the night.

WESTERN UNION WAREHOUSE BURNED.—The supply warehouse of the Western Union Telegraph Company at 152 Franklin Street, New York, was destroyed by fire Dec. 8, entailing a loss of between $175,000 and $200,000. By the same fire the Gold & Stock Telegraph Company lost about $20,000 worth of stock tickers.

NOBEL PRIZES.—It is announced that Nobel prizes have been awarded, in physics, to Prof. Gabriel Lippmann, of the University of Paris; and in chemistry to Prof. Ernest Rutherford, director of the physical laboratory of the University of Manchester, England. The former is known through his work in electricity and color photography; the latter for his advanced studies in radioactivity.

CONSERVATION CONGRESS.—A second meeting of the Conservation Congress was held in Washington last week under the auspices of the new National Conservation Commission, and was very well attended. Both President Roosevelt and Judge Taft took part, and 30 governors of States participated. Steps were taken, and motions approved, in favor of the protection of waterways and water powers, as well as forests and fuel supplies.

MEETINGS OF GENERAL ELECTRIC MANAGERS.—Managers of the various departments of the General Electric Company will hold meetings at the Fort Wayne Electric Works, Fort Wayne, Ind., Dec. 16 and 17 and Dec. 29. At the meeting of Dec. 16 the principal subject for consideration will be ways and means for bettering production at the least cost. At the meeting of Dec. 29 representatives from the various lamp factories operated by the General Electric Company will discuss the lamp situation from the same standpoint.

NON-MAGNETIC YACHT.—The Carnegie Institute, Washington, has awarded a contract for a vessel to be used in carrying out its program of magnetic surveys over the parts of the oceans where the earth's magnetic data have not yet been accurately determined. The vessel will contain no magnetic material, except possibly the crank shaft, which may have to be made of steel. Otherwise the only metals to be used will be bronze and manganese alloy. The yacht will be propelled by a gas engine, supplied from a gas-producer outfit.

DEVELOPMENT OF THE ELECTROMAGNETIC TELEGRAPH RECALLED.—A fire has destroyed the building of the Speedwell Iron Works, at Morristown, N. J., in which Morse and Alfred Vail labored in the development of the electromagnetic telegraph. The iron works were then owned by Judge Vail, father of Alfred Vail, who furnished the funds that enabled the Morse telegraph to be brought to the practical stage. The Vail family has always contended that the inventions and work of Alfred Vail conduced most toward the final success of this form of the electric telegraph.

FRANKLIN INSTITUTE.—Dr. W. H. Wahl, the veteran and devoted secretary of the Franklin Institute, Philadelphia, has just resigned to the deep regret of the management and members. His health has been poor for some years past, and he has had the help as assistant secretary of Mr. Rigling, the librarian of the Institute. The management has recommended the election of Mr. James Christie, the well-known mechanical engineer, now a member of the board, who will serve without compensation. Mr. Rigling will continue as his assistant.

GAS ENGINE ASSOCIATION.—The Internal Combustion Engineers Association has recently been formed in Chicago with a national framework and with a membership now comprising Illinois, Ohio, Indiana, Iowa, Wisconsin, Missouri and California. Its chief aim is to help the manufacturers of gas engine equipment toward a greater uniformity in detail of design, material and workmanship. The president is H. R. Linn, of Postel & Linn, consulting engineers, Chicago; vice-president, T. J. Bent, chief engineer, Illinois Steel Company; treasurer, T. J. Babcock; secretary, Walter A. Sittig.

NORTHWESTERN CONVENTION.—The Northwestern Electrical Association convention for 1909 will be held at Hotel Pfister, Milwaukee, Jan. 20 and 21. We are advised by President P. H. Korst that among the features on the program will be an address by Prof. B. H. Meyer, chairman of the Railroad Commission of Wisconsin, and one by Frank G. Vaughn, on the new rules and regulations of the Railroad Commission. Among the papers to be presented are one on "Tungsten Lamps" and another on "Storage Battery Auxiliaries." An invitation to visit the West Allis shops of the Allis-Chalmers Company has been accepted. Further details of the program will be published later.

Power Plant and Heating System at U. S. Naval Hospital, New Fort Lyon, Col.

BY A. P. BALL.

DURING the past year the United States government has turned the old Fort Lyon, in Bent County, Colorado, into an elaborate hospital for consumptives of the navy. The reservation is now called New Fort Lyon. It is admirably located on the high prairie plateau, approximately seven miles from the town of Las Animas, which is on the main line of the Atchison, Topeka & Santa Fé Railroad.

The old fort was famous in Kit Carson's time. It consisted of a number of adobe buildings, most of which, including Kit Carson's living quarters, have been utilized and rehabilitated for hospital purposes. They have been transformed partly into quarters for the commandant, Dr. Hibbett, and for his medical staff, and partly into storerooms. To this have been added a number of new frame buildings, which serve as patients' wards and as quarters for the hospital stewards. All told, there are now some 40 buildings of various descriptions. The reservation covers a territory of approximately one-quarter of a square mile.

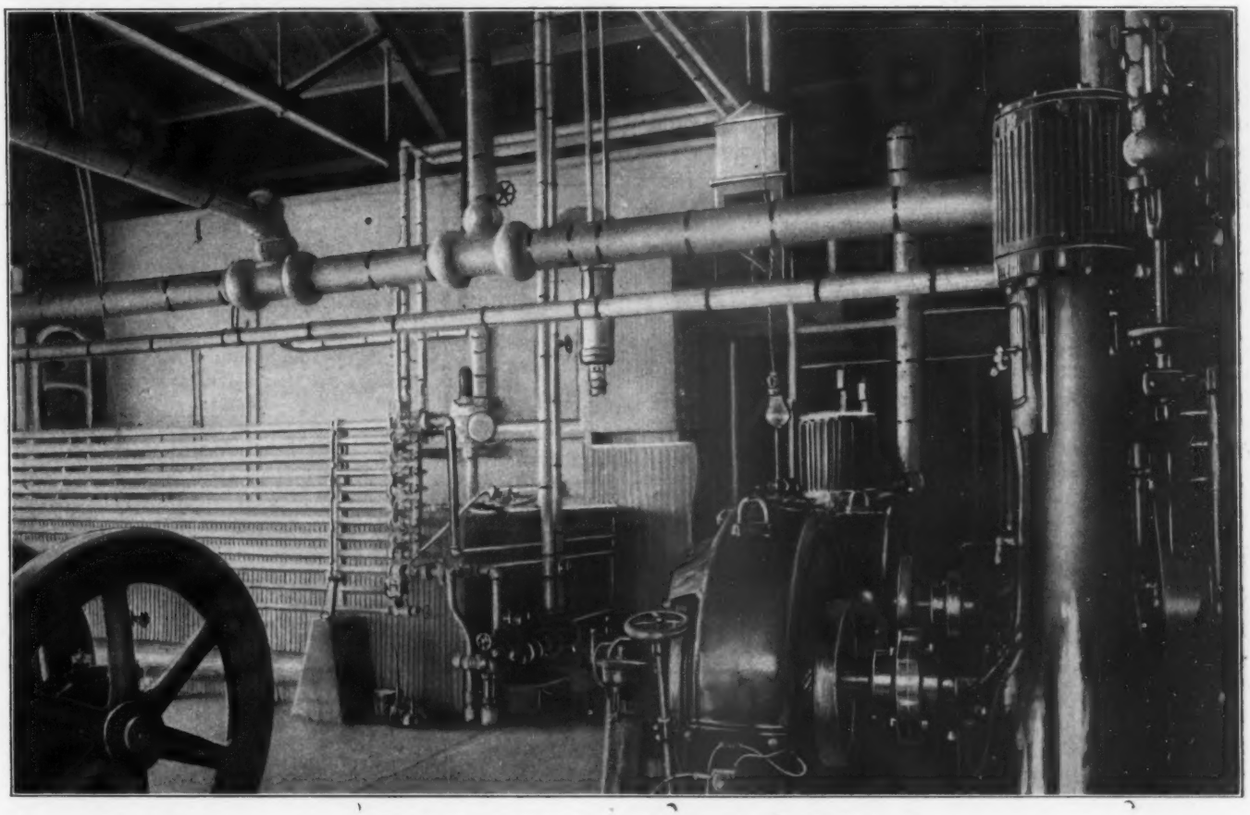


FIG. 1.—GENERAL VIEW OF INTERIOR OF POWER PLANT.

To furnish water, light, heat, power and ice to the reservation and to take care of all refuse, a very interesting central power plant, combined with a heating and lighting system, has been installed. The plant has recently been turned over to the government, and, inasmuch as it includes a number of unique features, the following short description and illustrations will doubtless prove interesting.

Power Plant.

The power plant is located on the outskirts of the reservation. The old fort was seriously handicapped by lack of water, which had to be brought from a considerable distance. The hospital authorities, therefore, decided to insure their independence in this respect by drilling two wells to ground water, about 250 ft. deep, and it is in the neighborhood of these wells that the power plant was erected.

The building is of cut stone taken from a quarry on the reservation. The chimney is of sheet iron, 4 ft. in diameter and 100 ft. high. To the right of the power house a low, square building, one of the old military buildings, was turned into a "sump," the upper parts of the walls being taken down and the cellar lined with concrete to form a basin for receiving the water as it is pumped from the wells.

The pumping is done by means of an air-lift system, the compressed air being furnished by two steam-driven air compressors, placed inside the power house. From the sump two Underwriters' fire pumps, utilized as service pumps, and also placed inside the power house, convey the water through an 8-in. main to a steel water tank of 100,000-gal. capacity, which is located on the highest point of the reservation, and is sufficient for supplying drinking water to the hospital for a number of days, besides serving as an emergency storage for fire purposes.

The power house proper is divided by a party wall into two main rooms, the engine room and the boiler room. Fig. 1 shows the interior of the engine room, the party wall being just visible on the right-hand side of the picture. In the foreground are two electric generating sets consisting of vertical engines direct-connected to direct-current generators of a capacity of 20 kw each, and wound for 250 volts. The switchboard controlling these generators is placed right next to and behind the engines.

On the left of the picture are to be seen the flywheels of one of the air compressors. Continuous water supply being a serious question, there are two air compressors, each capable of pumping both wells, so that one unit can always be kept in reserve. In line with the air compressors, but not visible in the picture, are the two Underwriters' fire pumps. In the rear of the engine room is a 10-ton ice-making plant with its own distilling and compressing machinery. This ice-making plant is operated in connection with three cold-storage rooms maintained at different temperatures for the storage of meat and other perishable provisions for the hospital.

Fig. 2 shows the interior of the boiler room. There are three boilers of the locomotive type, each having a heating surface of about 990 sq. ft. on fire tubes and a grate surface of

about 28 sq. ft. The boilers and steam domes are completely covered with 85 per cent magnesia insulation, as are also all steam, exhaust and hot-water lines. In the rear of the boiler room against the party wall are three heaters which furnish the hot water for heating all the buildings of the reservation. In a large heater, shown on the right, exhaust steam is used, while to the two smaller heaters on the left, live steam is supplied. Underneath these heaters and along the party wall are placed two boiler feed-pumps, a boiler feed-water heater, two hot-water circulating pumps and an expansion tank with air compressor regulator to maintain proper pressure in the hot-water heating system throughout a wide range of temperature.

The boiler feed-pumps can take water from the sump or from the service pipes, and they pass it through the feed-water heaters into the boilers. Should the feed pumps fail, the boilers can be fed by means of injectors. The two circulating pumps serve for forcing water through all three hot-water heaters, into the heating mains, which lead from the power house toward the reservation, by-passes being provided for each heater, so as to allow continuous operation even in case repairs to one of the heaters should become necessary.

Figs. 1 and 2 together give a good idea of the power-house piping. From the domes of the boilers steam of 100-lb. working pressure is led through U-bends of a radius of about 2½ ft. to a 6-in. header, which runs over the top of the boilers through the party wall. Branches lead to the live-steam heaters, the generator sets, the ice-making machinery, the air compressors, the various pumps, etc. All branch lines are taken out from the top of the header.

The machinery in this power house may appear to be somewhat crowded, but it just suits the sailors who operate it, as it reminds them of conditions on board ship.

Electric Lighting System.

From the switchboard in the power house a pole line leads along the main streets of the reservation. All buildings are electrically lighted by means of incandescent lamps. In addition, there are 40 incandescent street lamps for general outside illuminating purposes.

Hot-Water Heating System.

From the heaters in the power house the hot water is led through a pair of 6-in. mains to a point about 250 yards distant, where several branches are taken off and run to the different rows of houses. Each building has its own service connection, and each room one or more hot-water radiators. After being cooled, the water is returned through pipes of the same size as the circulating pumps and from there again sent through the heaters and into the heating system.

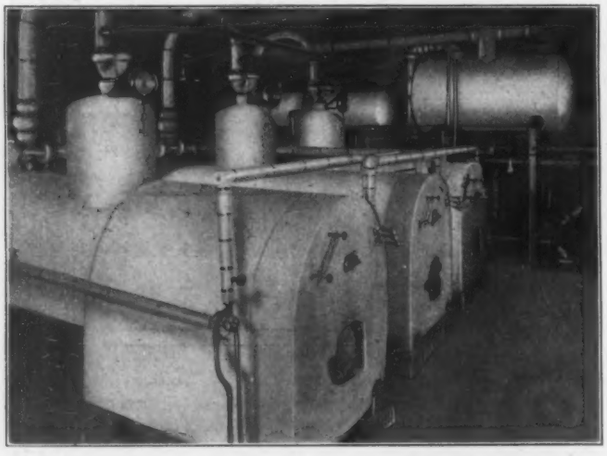


FIG. 2.—VIEW OF INTERIOR OF BOILER ROOM.

Fig. 3 shows the trench (during construction) in which the heating mains are taken out of the power house. All told there are several miles of similar trench. The trench is made of concrete, and the pipes rest on rollers supported by the conduit walls, a clearance of 2 in. being allowed between pipes as well as between pipes and concrete. The trench is covered with reinforced concrete slabs. The illustration shows part of the trench, with pipes installed ready for service, covers in place and trench partly back filled. It also shows one of the expansion joints, which are placed at intervals of about 300 ft. and which consist of steel U-bends of various dimensions according to diameter of pipe. The trenches around these expansion joints were kept open until the plant was placed in actual operation and it was very interesting to watch the bends close and open up during the tests, according to increase and decrease in the temperature of the water inside the pipes.

FIG. 3.—VIEW OF TRENCH UNDER CONSTRUCTION.

Manholes are provided at all important crossings, and all branch lines are furnished with stop valves at their beginning and end.

Before covering and backfilling the trenches, they were entirely filled with sponge asbestos and the cover slabs were sealed to the sides of the conduit by cement mortar. The conduits were carefully drained toward the manholes, and special drainage pipes connect the lowest points of the manholes with the sewerage system of the reservation. The entire hot-water heating system is thus thoroughly insulated against heat losses and protected against damage from moisture and water.

The plant also includes a garbage crematory, with Morse type of furnace suitable for taking care of 6 tons of garbage and refuse in 24 hours. The engineers of the plant were Muralt & Company, of New York.

Producer Gas Plant at Fairmont, Minn.

The city of Fairmont, Minn., at its municipal electric lighting plant has installed two gas-engine units, operated from producer gas. Both engines are of the Munzel type, made by the Minneapolis Steel & Machinery Company. These engines are shown in Figs. 1 and 2. One of these engines is of the twin, or double-cylinder, type, rated at 160 hp. The other is a single-cylinder engine rated at 80 hp. The 160-hp engine is belted to a 100-kw, three-phase, 60-cycle, 2300-volt Western Electric alternator. The 80-hp engine is belted to a 55-kw alternator. Two 160-hp gas producers furnish the fuel for the engines.

The engines and producers erected, including foundations, cost $66 per horse-power, or $102 per rated kilowatt. The first cost of such a plant is, of course, considerably higher than that of a cheap type of steam plant. The coal economy, however, is much better than could be expected from a steam plant of this size.

From Sept. 7 to Oct. 6 (30 days) the fuel consumption of the plant is stated to have been 41,275 lb. of anthracite coal, costing $6.20 per ton. This would make the monthly fuel bill $128, which is very low for a plant of this size operating 24

hours per day, as any central-station man operating a steam plant of this capacity can testify. Of course, a producer gas plant of this kind will show relatively greater economy where coal is high, as in Minnesota, than in soft coal mining districts.

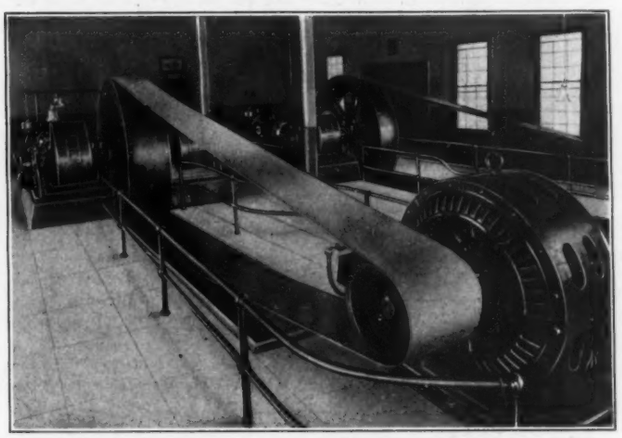


FIG. 1.—GENERATOR BELTED TO PRODUCER-GAS ENGINE.

No accurate records are obtainable as to the output of the plant, as watt-hour meters have not been installed on the switchboard. Some rough estimates may be made from the switchboard ammeter readings. For a month, from Sept. 7 to Oct. 6, half-hourly switchboard ammeter readings show that the output was 22,100 kv-amp hours. The all-day power factor is, of course, a matter of surmise. Assuming it to be 85 per cent, the output for the month would be 18,700 kw-hours. This, with a consumption of 41,275 lb. of coal, would mean 2.2 lb. per kw-hour. With coal at $6.20, this would be a cost of $0.0068 per kw-hour. Fig. 4 shows the daily load in amperes at 2300 volts on one phase of the three-phase system. From this it is seen that for much of the time the small 55-kw unit is operated at about half load. The 55-kw unit is run from about 11 p. m. until 4 p. m. the next day, and the 100-kw unit the balance of the time. As a day service had been given for only eight months previous to the time this load curve was taken, there had not been time to work up much day load.

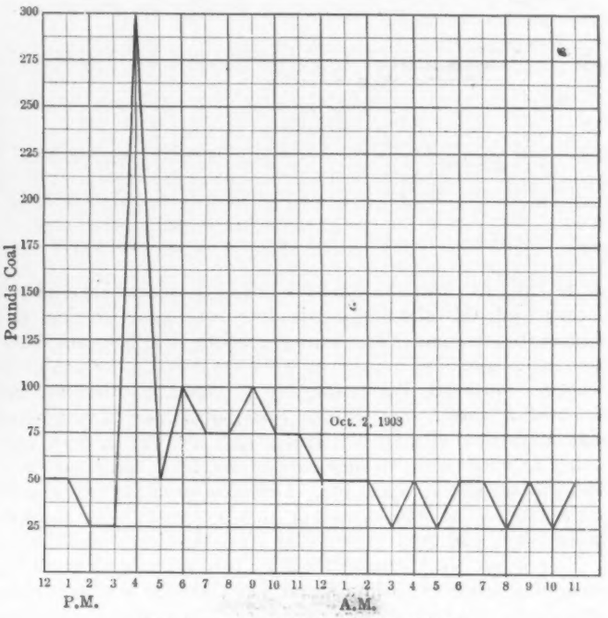


FIG. 3.—COAL RECORD FOR 24 HOURS.

Mr. Alfred Horne, superintendent of the plant, to whom we are indebted for all the information furnished in this article, states that so far as the care of the gas engines is concerned, they require fully as much attention as steam engines and are hardly as reliable, on account of the more delicate parts. Experience has shown that when the operators get acquainted with the engines and producers and learn their wants, that there need be very little trouble with them. The equipment at

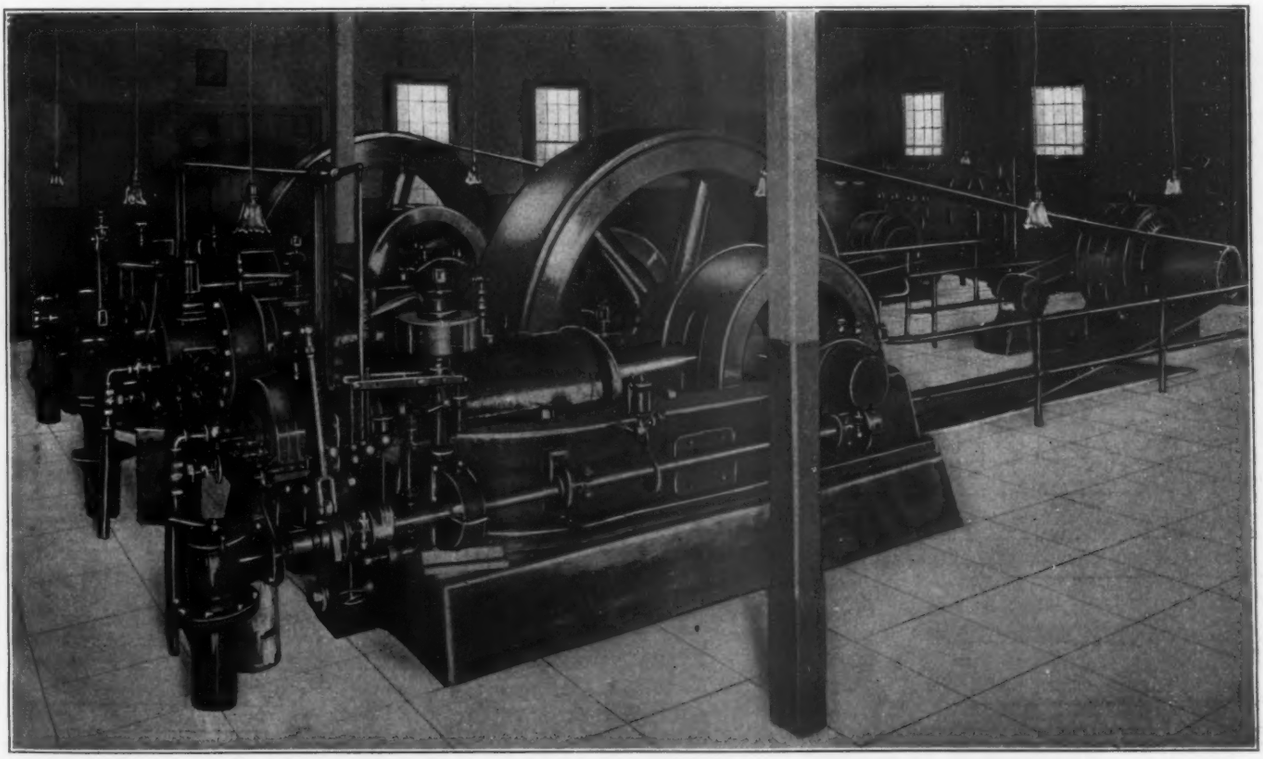


FIG. 2.—PRODUCER-GAS ENGINES, FAIRMONT, MINN.

Fairmont has been running along smoothly and the management is well pleased with the installation.

In Fig. 3 is shown the curve plotted from the hourly coal records which are kept for each day. The large amount of coal used at 4 o'clock is caused by cleaning the producer. As

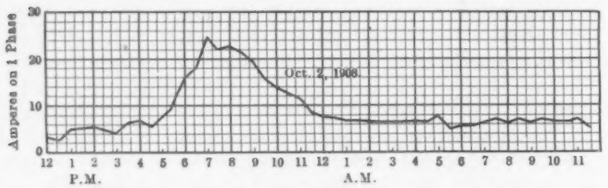


FIG. 4.—LOAD CURVE ONE PHASE OF THREE-PHASE BALANCED LOAD.

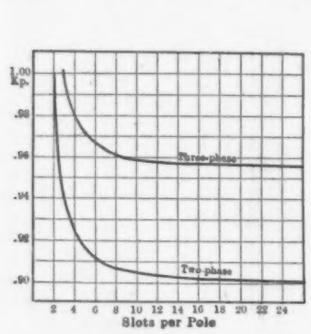
it is hard to clean the producer when it is working under a heavy load, this cleaning out is done before the evening load begins to come on. The cleaning consists of pulling out clinkers and ashes. The amount of work required on the producers depends much on how much care is taken. If they are not allowed to clinker, there is little work, but if they are neglected and allowed to clinker, Mr. Horne says, there is at least four times as much work to take care of the fires, and it will also have a bad effect on the gas. Only one producer is operated at a time. The one in use in October, when these records were taken, had been in operation since April continuously.

To sum up, Mr. Horne thinks there is as much work in taking care of a producer as in a steam plant, but the producer plant attendance required is more particular. As a rule, a new man will declare he would rather take care of four or five steam boilers than one producer, but he gets over that when he becomes acquainted with the producer.

Magnetizing and Potential Coefficients of Polyphase Windings.

By R. E. Hellmund.

In a paper presented before the last annual convention of the American Institute of Electrical Engineers, the writer outlined a graphical method by which the various coefficients for determining the field strength and the value of the magnetizing cur-



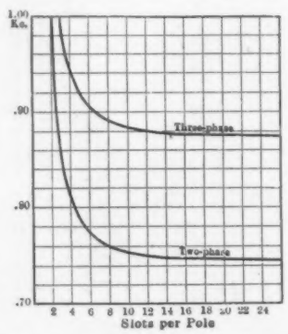


FIG. 1.—POTENTIAL FACTOR DISTRIBUTION. FIG. 2.—CURRENT FACTOR DISTRIBUTION.

rents of polyphase induction motors may be calculated accurately. Certain of the results obtained by this method are somewhat different from the values given in a number of test books, which, as a rule, use an approximate method for evaluating the coefficients. It may be of interest, therefore, to give the results obtained by the writer's method as far as required for practical purposes. The data relating to fractional-pitch windings have not been previously published.

POTENTIAL FACTORS.

Assume initially a machine with one slot per pole per phase and coils having a throw equal to the pole pitch; that is, 180 electrical space-degrees. The e.m.f. counter generated in this winding by a certain field ϕ of sinusoidal space distribution and uniform speed of rotation may be designated as E_1. If the same number of turns is equally distributed into n slots per pole per phase, the total e.m.f. E_n produced by the same flux is somewhat smaller than before, because the e.m.f. counter-generated in the coils in the different slots are out of time-phase with each

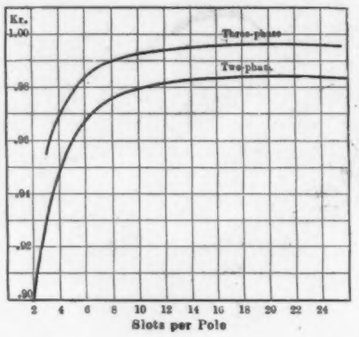


FIG. 3.—REACTANCE DISTRIBUTION FACTOR FOR FULL-PITCH WINDINGS.

other. The difference may be taken into consideration by a factor k_p, which may be called the "potential-distribution factor." That is to say,

$$k_p = \frac{E_n}{E_1} \qquad (1)$$

Values for k_p are shown by the curves of Fig. 1 for two-phase and three-phase windings.

If the coils are given a fractional pitch, that is, if they extend over an arc less than 180 electrical space-degrees, the e.m.f. counter generated by the same flux in each coil or phase-winding is reduced, since the e.m.fs. produced in the two sides of a coil are out of time-phase with each other. The difference between the e.m.f. $e\pi$ produced in a full-pitch coil and the e.m.f. $e\alpha$ counter generated in a coil extending over an angle of α electrical time-degrees, may be taken into consideration by a factor c_p, which may be called the potential pitch factor. That is,

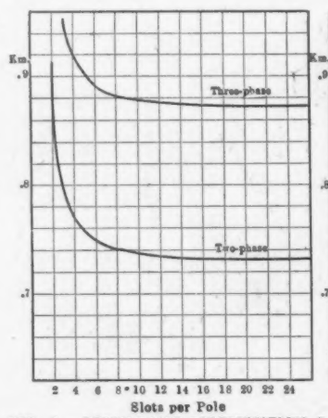
$$c_p = \frac{e\alpha}{e\pi} \qquad (2)$$

Values for c_p are represented by curve c_p of Fig. 6, or they may be ascertained from the equation (3).

$$c_p = \sin\frac{\alpha}{2} \qquad (3)$$

CURRENT FACTORS.

Assume, now, that a m.m.f. of a certain number of ampere-turns in a full-pitch winding wound in one slot per pole per phase produces in case of an open-circuit secondary a field which



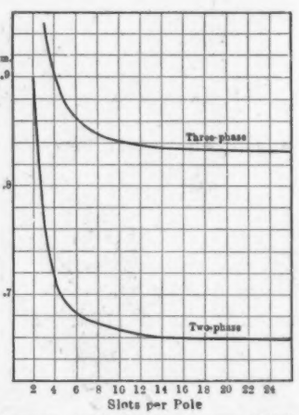


FIG. 4.—RESULTANT DISTRIBUTION FACTOR. FIG. 5.—MAGNETIZATION FACTOR DISTRIBUTION.

is equivalent to a sinusoidal field ϕ_1. If the same number of turns is equally distributed into n slots per pole per phase they will, with the same total ampere-turns, produce a field which is equivalent to a sinusoidal field ϕ_n, which is smaller than ϕ_1. The total magnetizing effect is smaller, because the magnetizing

effect which coils of a certain phase winding have upon some of the teeth is partly or entirely neutralized by the opposite magnetizing effect of coils of the same winding. The difference may be taken into account by a factor which may be called the "current distribution factor." That is,

$$k_o = \frac{\phi_n}{\phi_1} \qquad (4)$$

Values for k_o are indicated by the curves of Fig. 2.

If the coils extend over an arc less than 180 electrical space-degrees, the magnetizing effect Θa of each coil is smaller than the magnetizing effect θ_n of a 180-deg. coil because the m.m.f. acts upon a smaller area. The difference may be taken into consideration by a factor which may be called the "current-pitch factor."

$$c_o = \frac{\theta a}{\theta \pi} \qquad (5)$$

The value of c_o, as determined for a two-phase winding with eight slots per pole, is shown by the curve c_o of Fig. 6.

REACTANCE FACTOR.

If the secondary of an induction motor is short-circuited and the rotor is allowed to run at absolutely exact synchronous speed, certain currents will be produced in the secondary. These currents react upon the field flux and change the primary magnetizing current to a certain extent. This change may be taken into consideration by a factor which may be called the "reactance-factor."

$$K_r = \frac{I_o}{I_c} \qquad (6)$$

In this equation, I_o is the magnetizing current for the open-circuited secondary and I_c the magnetizing current for the closed secondary with rotor at synchronous speed.

The reactance-factor varies with the number of slots per pole and with the coil-pitch. The curves of Fig. 3 give the reactance-factor for full-pitch windings. The curve shown in Fig. 7 indicates the variation of the reactance-factor with change in the coil-pitch for a two-phase winding with eight slots per pole. Obviously one may write,

$$K_r = k_r \times c_r, \qquad (7)$$

where k_r is the "reactance-factor" for any full-pitch winding

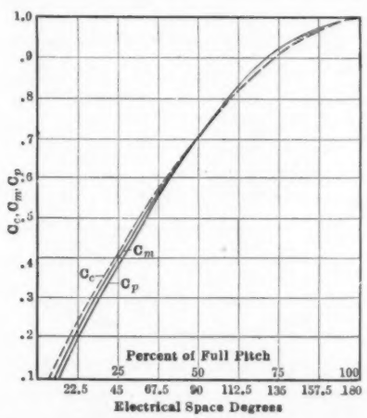


FIG. 6.—CURVES SHOWING THE VARIOUS PITCH FACTORS.

and c_r is the ratio of the reactance-factor for the fractional-pitch winding to the reactance-factor of the full-pitch winding of the same number of slots.

MAGNETIZATION-FACTOR.

Since in practice the separation of the current factors and reactance-factors is of no value, one may introduce their products, which may be called the "magnetization-distribution-factor." That is,

$$k_m = k_o \times k_r \qquad (8)$$

Values for k_m are shown by the curves of Fig. 4.

The "magnetization-pitch-factor" is,

$$c_m = c_o \times c_r \qquad (9)$$

Values of c_m for two-phase windings with eight slots per pole are shown by curve c_m of Fig. 6.

It will be seen that for all pitches, of practical importance, that is, covering from 70 to 180 space-degrees, the value of c_m differs by less than 1 per cent from c_p.

One may, therefore, set

$$c_m = c_p = \sin \frac{a}{2} \qquad (10)$$

Similar results have been obtained for two-phase windings with other numbers of slots per pole. For three-phase windings the differences between c_m and c are even smaller than 1 per cent.

RESULTANT-FACTOR.

For formulas in which the magnetizing current is expressed as a function of the e.m.f., it is most convenient to combine k_p with k_m, and c_p with c_m. One may, therefore, introduce a "resultant-distribution-factor."

$$k_r = k_p \times k_m \qquad (11)$$

Values for k_r are shown by the curves of Fig. 5. Moreover,

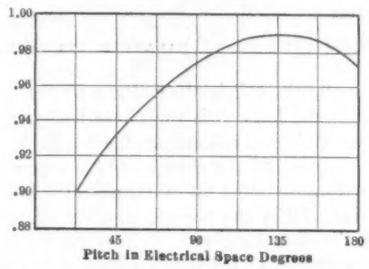


FIG. 7.—CURVE SHOWING THE VARIATION OF THE REACTANCE FACTOR WITH THE COIL PITCH FOR A TWO-PHASE WINDING WITH EIGHT SLOTS PER POLE.

$$c_r = c_m \times c_p = \sin^2 \frac{a}{2} \qquad (12)$$

If all factors are combined into one, there is obtained

$$K = k_r \times \sin^2 \frac{a}{2} \qquad (13)$$

APPROXIMATE COEFFICIENTS.

It will be noticed that all curves for the distribution coefficient are comparatively flat when at least eight slots per pole are used and that the coefficient values are almost constant. It is permissible, therefore, to assume,

$k_p = .903$ for	two-phase	(exact within	.4%	for not less than	8	slots per pole.					
.958 "	three-phase	"	"	.4%	"	"	"	"	8	"	"	"
$k_m = .736$ "	two-phase	"	"	.8%	"	"	"	"	8	"	"	"
.875 "	three-phase	"	"	.8%	"	"	"	"	8	"	"	"
$k_r = .665$ "	two-phase	"	"	1.2%	"	"	"	"	8	"	"	"
.838 "	three-phase	"	"	1.2%	"	"	"	"	8	"	"	"
$K = .665 \sin^2 \frac{a}{2}$	for two-phase	"	"	2%	"	"	"	"	8	"	"	"
$K = .838 \sin^2 \frac{a}{2}$	for three-phase	"	"	2%	"	"	"	"	8	"	"	"

Even for six or seven slots per pole, the above values give results which are not more than 4 per cent in error. Since the errors introduced by assumptions other than those relating to the coefficients in any calculation of this kind are much larger, it seems fully justifiable to use the latter approximate values in place of the exact values of the curves.

Errors in Some Methods of Calculating Alternating-Current Transmission Lines.

BY L. W. ROSENTHAL.

All of the common methods of calculating the size of alternating-current transmission lines from the volt loss are either indirect or inaccurate. This condition results from the fact that it is impossible to devise an exact formula for any alternating-current system which will directly indicate the size of wire required for the transmission of energy at a given rate with a given volt loss. Methods of the indirect class require that the size of wire be known and hence are trial methods. Approximations of the second class may be sufficiently close under certain conditions, but they give wholly erroneous results for other practical cases, as will be shown below.

The proper size of wire may be directly calculated for any

given power loss, but this solution does not constitute a direct method, since the condition of determining importance is invariably one of regulation. Direct methods, and others which could be readily transformed into such, have been in common use for some time. The purpose of this article is to point out the practical conditions under which these solutions may lead to undesirable errors.

Vector diagrams of balanced transmission lines are shown in Fig. 1 for lagging and leading currents. In Fig. 1, *OI* is the

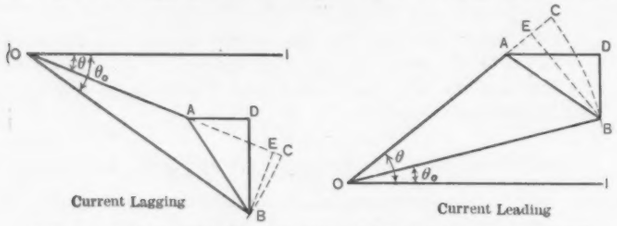


FIG. 1.—VECTOR DIAGRAM OF BALANCED TRANSMISSION LINE.

current in the circuit, *OB* is the voltage at the generator, *OA* is the voltage at the load, Θ is the phase angle of displacement of the current and the voltage at the load, Θ_0 is the phase angle of displacement of the current and the generator voltage, *AD* is the resistance volts of the line, *DB* is the reactance volts of the line, *AB* is the impedance volts of the line, $AC = OB - OA$ is the volt loss, and *AE* is the projection of *AB* on *OC*. The volt loss in the line equals the difference between the volts at the generator and the load. It bears no simple relation to the resistance drop, reactance drop or impedance drop, and in per cent it may be much greater or much less than the per cent power loss.

All common methods of directly calculating the size of wire from the volt loss are based on the following assumptions:

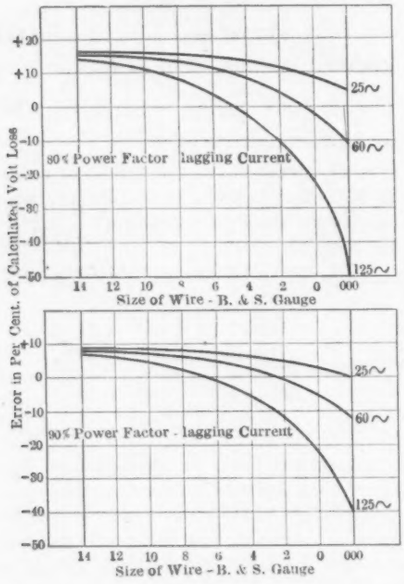
1. Resistance volts = volt loss (in Fig. 1, $AD = AC$).
2. Impedance volts = volt loss (in Fig. 1, $AB = AC$).
3. Projection of impedance volts on vector of delivered volts = volt loss (in Fig. 1, $AE = AC$).

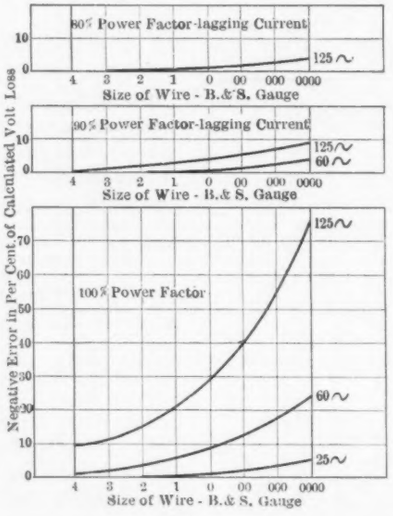
The first approximation is often used in the calculation of underground cables and interior wires, where the proximity of the conductors greatly reduces the reactance drop. In practical cases the error of this assumption may be very large, and either positive or negative. The latter condition confines the maximum error within smaller limits than would otherwise obtain, but at the same time it indicates wires which may be too small as well as too large. Fig. 2 shows the error of this assumption in per cent of the calculated values, for copper cables in underground or interior conduits. For greater separation of conductors, the errors would be larger. At power factors very close to unity the error is reduced, although it may still be appreciable.

A familiar method of line calculation assumes that the impedance volts equal the volt loss. The two are the same only when the power factors of the load circuit and of the line are equal, but as this condition is departed from, the error increases with great rapidity and reaches absurd values in practical cases. The wires determined by this method will be too large. Fig. 4 shows the error for copper wires on 36-in. centers for a true loss of 10 per cent of the generated volts. Thus in the extreme case of No. 0000 wires at 125 cycles per second and 100 per cent power factor, the assumption gives a positive error of 67 per cent, which leads to a volt loss of 30 per cent instead of the true value of 10 per cent. In general, the approximation is wholly erroneous for high commercial frequencies, for high or leading power factors, or for large wires. The error decreases slightly as the per cent volt loss increases, but becomes larger with greater spacing of wires.

The third method, based on the assumption that the projection of the impedance volts on the vector of delivered volts equals the volt loss, gives close results under certain conditions, but the values may become absurd for high frequencies, for high or leading power factors, for large wires or for large per cent volt losses. For lagging currents the approximation always gives too small values of the volt loss and size of wires. Fig. 3 shows the errors for copper wires on 36-in. centers for a true loss of 10 per cent of the generated volts. The error increases very rapidly with the per cent volt loss and is larger for greater spacing of wires.

From the foregoing it is evident that none of the above methods is safe for a general solution of practical problems. Any of the approximations may lead to results wholly erroneous and to conductors entirely at variance with the specified requirements.


Error in Per Cent. of Calculated Volt Loss
80% Power Factor lagging Current
90% Power Factor - lagging Current
25~
60~
125~
Size of Wire - B. & S. Gauge



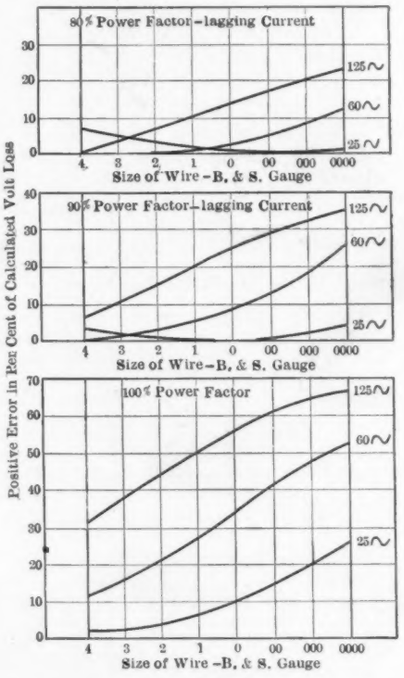


FIG. 2.—ERROR OF ASSUMPTION THAT RESISTANCE E.M.F. EQUALS VOLT LOSS FOR COPPER CABLES WITH 10/64-IN. INSULATION ON EACH CONDUCTOR. FIG. 3.—ERROR OF ASSUMPTION THAT PROJECTION OF IMPEDANCE E.M.F. EQUALS VOLT LOSS FOR COPPER WIRES ON 36-IN. CENTERS AND A TRUE LOSS OF 10 PER CENT OF THE GENERATED VOLTS. FIG. 4—ERROR OF ASSUMPTION THAT IMPEDANCE E.M.F. EQUALS VOLT LOSS FOR COPPER WIRES ON 36-IN. CENTERS AND A TRUE LOSS OF 10 PER CENT OF THE GENERATED VOLTS.

The Luminous Efficiency of Metal Filament Lamps.

BY W. W. COBLENTZ.

A knowledge of the laws governing the radiation of metals with variation in temperature is of interest in connection with the numerous speculations offered to explain the great light emissivity—that is, the high luminous efficiency of the new incandescent lamps with metal filaments.

Within the past few years several fundamental principles relating to the physical properties of certain substances have been sufficiently well established so that one can form a reasonable estimate of what to expect of similar substances, operated under similar conditions. One very important principle, established by Hagen and Rubens,[1] is the proportionality of the electrical conductivity and the reflecting power of a majority of the metals, covering the whole range of the Mendelejeff series, and it is reasonable to suppose that the few metals remaining uninvestigated will behave similarly in their reflecting power and other physical properties. From this relation it would appear that the reflecting power R must decrease with rise in temperature of the metal, for the electrical conductivity of any given metal decreases with rise in temperature. It is evident from this and from Kirchhoff's law of proportionality of emission and absorption ($1-R$, for metals) that the emissive power of metals must increase with rise in temperature, corresponding with the decrease in the reflecting power. From this it would appear that the metals cannot have a radiation constant, a, of the type which obtains for a "black body," in which $a-1=4$ in Stefan's law of total radiation. As a matter of fact, this so-called "constant" has been found to be a function of the temperature. (See Fig. 1.)

Another property of metals is their large absorption coefficient (low reflecting power) throughout or in narrow regions of the visible and ultraviolet spectrum, which must, therefore, exhibit strong selective emission in this part of the spectrum. It is, therefore, reasonable to suppose that such metals as tungsten, tantalum, etc., have also a low reflecting power in the visible and ultraviolet parts of the spectrum.

There are, therefore, three factors which are instrumental in producing a high luminous efficiency in metal filament lamps, namely, (1) a high melting point, which permits the lamps to be operated at a high temperature, thus throwing a greater proportion of the total radiation into the visible spectrum than obtains at lower temperatures. (2) A high emissivity ("selective emission") throughout the visible spectrum, due to the larger absorption coefficient in this region relative to the infra-red. (3) A high value of the so-called radiation constant a, which suppresses the infra-red radiation.

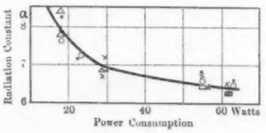


FIG. 1.—RADIATION CONSTANT OF TUNGSTEN LAMP.

The first two factors are fairly well established, and it is the purpose of the present paper to discuss some results obtained in an investigation of the third factor, viz., the so-called radiation constant, a.

Since it is impossible to measure the temperatures of these metal filaments, it is necessary to assume that they have the same radiation laws as a "black body" and platinum, in which the spectral distribution of energy has been found to be represented by the Wien equation:

$$E_\lambda = c_1 \lambda^{-a} e^{-c_2/\lambda T} \qquad (1)$$

where $E\lambda$ is the bolometer-galvanometer deflection for a given wave length, λ and temperature, T. The other quantities in equation (1) are constants. Fortunately, the exponent a may be ascertained from the spectral energy curve in which the temperature T is kept constant, without knowing the actual temperature, for it can be shown from equation (1) that the ratio of the emissivities (the observed bolometer-galvanometer deflections) E and E_{max} for any two wave-lengths λ and λ_{max} is:

$$\frac{E}{E_{max}} = \left\{ \frac{\lambda_{max}}{\lambda} e^{\frac{\lambda - \lambda_{max}}{\lambda}} \right\}^a \qquad (2)$$

from which a may be computed. With this equation it is possible to obtain some idea of the probable total emissivity of the metals as to whether it is proportional to the fourth power ($a-1=4$ for a "black body," $a-1=5$ for platinum) or to some higher power of the absolute temperature.

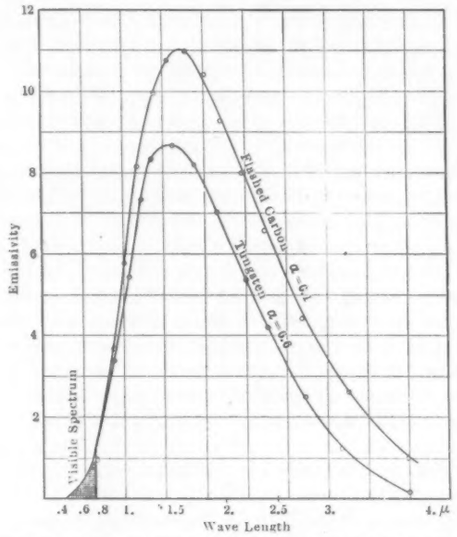


FIG. 2.—DISTRIBUTION OF ENERGY FLOW IN THE SPECTRA OF FLASHED CARBON AND TUNGSTEN.

In order to carry out such an investigation the spectrum of the radiating filament is produced by means of a prism which is transparent to heat waves. This spectrum is explored with a bolometer or a thermopile.

An investigation was made of the so-called radiation constant a of various filaments (usually 110-volt lamps), including tungsten, tantalum, osmium, platinum, carbon, etc., for various values of power consumption. The results obtained were quite unexpected in that the "constant" was found to be a function of the specific power consumption—that is, of the temperature. This relation is well illustrated in Fig. 1, which gives the values of a, of a 110-volt tungsten lamp, at various temperatures. At low temperatures the value is unusually high, but drops to $a=6.6$ on normal operation. A similar variation in a was found for all the other metals examined, including platinum. It was found that in all cases the so-called constant a was higher than that of platinum. Tungsten and osmium have the highest values, viz., $a=6.6$ and 6.9, respectively, on normal operation.

For tantalum and graphitized carbon, the value is close to that of platinum, namely, $a=6.1$ to 6.3.

It is, of course, understood that the larger the value of a, the higher the temperature must be raised in order to obtain the same emissivity in the visible spectrum as obtains for a substance having a smaller value of a. Moreover, the higher the value of a, the greater the suppression of the radiation in the infra-red. This fact is well illustrated in Fig. 2, which shows the distribution of energy flow in the spectra of a filament of flashed carbon and of tungsten, set to the same emissivity in the visible spectrum. The energy-flow curves show that the carbon filament emits almost one-third more infra-red energy than does the tungsten lamp. The tungsten lamp was operating at considerably below the normal voltage in order to obtain the same emissivity in the visible spectrum as for carbon, hence, it was not at its maximum efficiency. Nevertheless, it is more efficient than carbon, due to the higher value of the so-called

[1] Hagen and Rubens: *Ann. der Phys.*, p. 352, 1900; pp. 1 and 432, 1902.

radiation constant. On normal voltage the luminous efficiency of the tungsten lamp is still further increased, due to the high temperature at which this filament can be operated. A third (possible) factor which tends to increase the luminous efficiency of metal filaments, viz., an abnormally high emissivity throughout the visible spectrum to a wave-length of about 1μ, cannot be demonstrated by means of bolometric measurements, because the abnormally high emissivity, if present, must merge gradually into the normal emission which exists beyond 1μ in the infra-red, due to the uniform reflecting power.

As mentioned elsewhere in this article, such metals as platinum, iridium, etc., which, in the visible spectrum, have a low reflecting power (which rises rapidly to a high and constant value beyond 1μ in the infra-red) must emit an abnormal amount of energy in the visible spectrum, as compared with the region beyond 1μ, where the reflecting power is uniform and much higher in value. As already mentioned, it seems to be a physical property of metals to have a low reflecting power in the visible, and especially in the ultraviolet, part of the spectrum. All of the numerous metals thus far examined have this characteristic, and there are sufficient reasons for believing that those remaining unexamined have this same characteristic. This means that tungsten, tantalum, osmium, etc., like platinum, must have an abnormally high emission in the region of the spectrum from the ultraviolet to about 1μ in the infra-red. (It seems desirable to speak of the emission as being abnormally high in the "white metals" to distinguish it from the true "selective emission" in gold and in copper, which is caused by narrow bands of low reflectivity in the green and in the yellow, respectively, of these two metals.)

Whether or not there exists a high emissivity in the visible spectrum, the data presented are sufficient to account for the high luminous efficiencies of metal-filament lamps.

Electric Welding.

By A. E. Buchenberg.

Welding is the operation of uniting two or more pieces of the same or different metals by means of blows or pressure while the surfaces to be joined together are in a heated plastic condition.

The art of welding has been known for centuries. The ancients while working at their primitive forges discovered that two pieces of iron could be securely joined by raising each to a very high temperature, placing one piece upon the other and quickly hammering them together. Iron above all other metals is peculiarly adapted to welding from the fact that it becomes very plastic at high temperatures, while at the same time the "scale" or black oxide becomes fluid at a much lower temperature than the melting point of the iron itself and affords a very effective liquid flux.

Forge welding is and always has been an expensive operation and more or less unreliable unless done by an expert. In order to weld two pieces of iron in a forge the ends are first heated and "scarfed" to afford a liberal surface. They are then reheated until in the judgment of the blacksmith the temperature is somewhat higher than the proper welding heat. The scarfed ends are then placed on an anvil, treated with borax or other welding compound to form a flux and hammered together as quickly as possible. The quality of a weld made in this way depends upon several factors:

(1) Each of the surfaces to be welded together must be at the proper temperature for that particular grade of iron or steel at the time the blows are applied to force the surfaces together.

(2) To obtain a perfect weld all parts of the surfaces to be welded together must be forced into intimate contact by repeated blows.

(3) All burned metal and flux must be forced from between the welding surfaces.

The conditions for making a perfect weld vary for different metals. In the case of iron and steel the temperature must not be allowed to reach the melting point of the material or it will become "burned" and the mechanical properties of the metal destroyed. In the case of copper and brass the metal must actually fuse at the point of junction to obtain a weld.

The welding of copper, brass, bronze and other alloys of copper is not practical as a forge operation. In welding copper a very high temperature is required to bring the metal to the necessary plasticity. While in this condition and exposed to the air, very rapid oxidization takes place, and the scale formed is extremely difficult to treat with any flux. The metal is brittle near the welding temperature and to make matters worse the range of temperature between the plastic and the molten state is very small. In attempting to forge-weld brass, bronze and other copper alloys it is found very difficult if not impossible to prevent the oxidization of the alloy metals with their comparatively low melting temperatures before the copper component has reached a welding heat. Copper alloys are also found to be brittle near the welding temperature.

While welding is one of the most important operations in metal working, little progress has been made in the forge method. Reliable, accurate and rapid work is more and more in demand as metal manufacturing expands and higher working stresses and duplication of parts are called for.

Several systems of electric welding, notably the arc and the acidulated water systems, have been exploited; the present discussion will be confined to what is known as the Thomson process, brought out and commercialized by Prof. Elihu Thomson about 20 years ago. This system, which until a short time ago was protected by basic patents, fulfills all requirements for uniform, perfect, accurate and economical welding, at the same time affording speed, cleanliness and freedom from smoke gases, etc.

The design of an electric welding machine, which varies greatly for different classes of work, is determined by requirements of output, speed and accuracy. Machines may be found hand-operated, power-operated, semi-automatic and automatic, with a range of output from a few hundred welds per day to as high as 8000 or 10,000. The essential features of all machines are as follows: (1) A transformer, the primary coils of which are made up of a comparatively large number of turns of copper conductor of small cross-section and connected to an alternating-current circuit. The number of turns will depend upon the voltage of the supply circuit, while the size of the conductors will depend upon the transformer rating required to do the work for which the machine is designed. The secondary winding of the transformer consists usually of a single conductor in the form of a cast-copper bar of very large sectional area as compared to that of the primary conductors. The secondary current is thus of low voltage but enormous volume as compared to that in the primary circuit. (2) Copper jaws or dies to clamp the work while the weld is being made are either mounted directly upon the terminals of the secondary casting or attached to them by flexible copper conductors whose current-carrying capacity corresponds to that of the transformer secondary. (3) Provision is made for a small movement of the clamps toward and away from each other, and they are so arranged that mechanical pressure may be exerted to force together the ends of the abutting pieces after the proper welding temperature has been reached.

The underlying principle of electric welding is a very simple one, the machine being an adaptation of the heating effect of a current of large volume in a circuit one point of which is of relatively high electrical resistance. The two pieces of metal to be welded together are held in the clamping dies attached to the terminals of the transformer secondary with their ends abutting and thus complete the secondary circuit through the clamping dies, flexible leads and transformer secondary casting. The junction of the two pieces forms the point of highest resistance in the secondary circuit and practically all of the heating effect of the secondary current is concentrated at this point. As the two pieces become heated to a welding temperature at the point of contact, pressure is exerted to force the abutting ends together. The metal being plastic at this temperature the

entire end surfaces of the two pieces are forced into intimate contact and a perfect molecular union or weld is effected.

The heating effect of the current is equalized over the entire contact area at the point of weld, due to the increase in electrical resistance of metals with increase of temperature and the well-known tendency of electrical current to divide into paths inversely as the resistances. Thus if any parts of the surfaces in contact reach a higher temperature than others a greater volume of current is automatically shunted through the parts at the lower temperature, the whole tendency being to equalize the heat over the entire contact area. Thus the interior is at the same temperature as the exterior and the result is a perfect homogeneous weld.

Uniformly reliable and satisfactory results are obtained in the electrical welding not only of iron and steel, but also of copper, brass, bronze and many other metals and alloys. In fact, a metal that cannot be electrically welded is an exception.

Perfect and uniform welds can be made in copper and brass with the greatest ease. The molecular structure of the metal is not disturbed and the welds are in all respects equal in strength to any other part of the piece of equal area and will withstand an equal bending, rolling or drawing operation.

Since the temperature of the iron or steel to be welded must not be allowed to reach the melting point, considerable pressure is required to force the surfaces to be welded into intimate contact. In the case of copper or brass the metal must be allowed actually to melt at the junction and only enough pressure to force out the fused metal is required. In many cases no difficulty is experienced in welding together entirely different metals, such as iron and brass.

In welding copper, brass, copper alloys and other metals which must be allowed to fuse at the point of weld as stated above, it becomes convenient to make use of specially designed machines. These machines are so constructed that a constant pressure from a spring, weight, or other means is exerted between the ends of the pieces to be welded together. A circuit-breaker attached to the machine is set so that it is automatically opened and the current interrupted at the instant the two pieces are forced together, due to the fusing at the point of weld. The welding operation itself is thus entirely automatic and with a proper initial adjustment all welds are uniform.

When it is required that a piece of one diameter be welded to another of, say, smaller diameter but of the same material, one of two things is necessary in order that both pieces may reach the proper temperature at the same time. Either the end of the piece of larger diameter must be turned down to the diameter of the smaller piece for a short distance—say ¼ in. from the end—thus making the sectional areas of the two pieces equal at the point of weld, or the junction of the two pieces is not set central between the two dies—as is the case for stock of equal cross-section—but the piece of larger diameter is allowed to project somewhat farther beyond its clamping die or jaw than the smaller. When this is done the copper dies, now being set a greater distance back from the point of weld on the larger piece, will conduct heat away less rapidly on that side. With a proper setting of the work the heat will be uniform in both pieces. This method, however, will apply only where the difference in sectional area is comparatively small.

When different metals are to be welded together it sometimes becomes necessary to reduce the section at the end of one piece, that of the highest electrical conductivity, until the contact areas are such that the proper welding temperatures of the two pieces are reached at the same time.

In electric "butt welding" or "snap welding" as above described a small upset or fin of metal is thrown out all around at the point of weld, due to the end pressure forcing out all the burned and fluid metal. When necessary this fin is removed by placing the weld while still hot in a power press or under a drop hammer. When convenient an emery wheel is frequently used to remove this surplus material.

The heat conductivity of the metals to be welded is one factor in determining the amount of electrical energy required. A material of low heat conductivity, such as iron or steel, requires less energy per weld than a material of high heat conductivity, such as copper or brass. This is due to the small amount of the total heat generated at the weld being conducted to the clamping jaws and dissipated.

Some of the more important advantages of the electric welding machine over the forge operation are enumerated as follows:

(1) The amount of stock heated in making a weld is very small and practically confined to the space between the two clamping jaws. This distance varies from ⅛ in. to 2 in., depending upon the size of the stock to be welded. There is no scaling or blistering on either side of the weld.

(2) The heat is the same throughout the entire body of the metal at the point of weld. The surfaces are not exposed to the air at high temperature with consequent rapid oxidization, and the weld is as perfect inside the material as at the surface.

(3) There is no waste of material beyond the very small amount required for the upset or fin to make certain that all burned stock is forced out and intimate contact is obtained.

(4) No flux of any description is required.

(5) Electric welding is, or can be made, accurate for gage work by means of suitable gages and stops on the machine. The pieces to be welded together are held in perfect alignment by the clamping jaws of the machine.

(6) Electrical welds have proved absolutely reliable. The work is visible at all times during the operation and the proper welding temperature for any particular grade of metal can be accurately gaged.

(7) The welding machine makes no smoke or dirt and can be located in any convenient place about a factory.

(8) The operation of an electric welding machine is unaccompanied by any danger to the operator. The welding voltage used is so low as to make it impossible to obtain the slightest noticeable shock.

(9) The time required to weld small stock is only a very few seconds. As the stock becomes larger more time must be allowed for the material to reach the welding temperature. In any case the time required is very much less than with the forge operation.

(10) The cost of electrical energy required is small as compared to the fuel and maintenance charges of a forge, oil or gas furnace. The fact that power is used only during the short time required to make a weld and is zero during the time required to insert and remove the "work" is one of the factors affording the distinct economy of the electric welding machine.

Taxation of Water Power in One State That Is Developed in Another State.

BY ALTON D. ADAMS.

Prior to August, 1904, the mills of the Blackstone Manufacturing Company were located in the town of Blackstone, Mass., where the company also owned more than 250 acres of land with a dam, canal and fall along the Blackstone River, that developed water power for the mills.

In the above year the Blackstone Company built a new mill in Rhode Island, a few hundred feet from the old mills, and extended its canal about 20 ft. into that State, where the water power was developed and electrically transmitted to the new mill. Under this reconstructed plan, the gates, wheels and the power house were all in Rhode Island, and all of the water power was developed there. At the dam, in Massachusetts, the fall of the river was 15 ft., at the old mills the fall from the canal to the river was 29 ft., and at the new power house in Rhode Island the fall from the canal was 32 ft.

The assessors of the town of Blackstone taxed the property there, including the land, dam and canal, on the basis of its value as a source of power not only at the old mills, but also at the new power house in Rhode Island, and from this assessment the company appealed for an abatement of the tax. It was the contention of the company that the water power was annexed to its mill in Rhode Island and that the land and

structures in Massachusetts should not be taxed for any value based on their use or their capacity for use in the development of water power in Rhode Island. This contention was based largely on the case of Boston Manufacturing Company vs. Newton, 22 Pickering 22, the doctrine of which is stated in the headnote as follows: "Water power for mill purposes, not used, being merely a capacity of land for a certain mode of improvement cannot be taxed independently of the land." In the case just cited, the attempt was made to tax the water as a distinct subject, apart from the land over which it flowed, and the tax on the land itself was upheld, while that on the water was held to be invalid. The case, however, has been taken as authority for the proposition that when water is appropriated and used for power, it is, as between different owners and municipalities, taxed with the property to which it is applied.

In its opinion on the above Blackstone case, the court traces the reason for the rule last stated back to the Massachusetts mill acts, and says that these acts have been sustained upon the right of the Legislature to regulate the use of property for the best interests of the owners and of the public, when different persons have separate rights which have a common relation to certain property. Under the mill acts, one riparian owner on a stream has authority to so construct a dam on his property as to flood the lands of an upper riparian owner where the water power is undeveloped, for the private purpose of operating a mill, the lower riparian owner paying damages for the lands flooded. The lands of the upper riparian owner are clearly "taken" when flooded with water by a dam below, though the general rule is that private property can only be "taken" for a public use, but the mill acts have been sustained as a "regulation" of property, as above stated.

In the Blackstone case, the court goes on to say that while the rule, in Massachusetts, has been to tax water power with the particular land where it is developed, this rule is not to be followed as to water power developed in another State beyond the reach of Massachusetts law. The flow of the water and its fall in Massachusetts are natural elements of value in the land there, and as this flow and fall together with the dam and canal are used to develop water power in Rhode Island, the land with these elements of value should be taxed in Massachusetts with reference to their use in the other State.

The court cited several cases where the capacity of land for water power development was included as an element of its value for purposes of taxation, but mentioned only one Massachusetts case where land and hydraulic structures in one State have been taxed with reference to their value for the development of water power in another State, the case being that of Farmington River Water Power Company vs. County Commissioners, 112 Mass. 206. In this last-named case it appeared that the Farmington River Company owned 596 acres of land flooded for a reservoir by a dam in the town of Otis, Mass., that the company developed no water power, and that only a small amount of power was developed by anyone on the Farmington River in Massachusetts. The capital stock of the Farmington Company was mainly held by the owners of water powers used at mills along the Farmington River in Connecticut, and these owners had contributed the funds for the construction of the dam and reservoir in Massachusetts for the purpose of obtaining a more constant supply of water at their mills.

In fixing the value of the dam and reservoir at $20,000, for the purpose of taxation, the commissioners of Berkshire County, Massachusetts, did so in reference to the use of the dam and reservoir for the production of power in Connecticut. From this taxation the Farmington Company appealed, and set up the claim that the dam and reservoir had no market value and produced no income, but the tax was upheld.

The above cases evidently have an important bearing on the taxation of large hydro-electric plants, which utilize long stretches of rivers, and in a number of instances develop water power in one State with the aid of reservoirs and of the fall along a river in another State. One such instance may now be found in connection with the property involved in the above Farmington case, for the reservoir in Massachusetts still regulates the flow of the Farmington River, and on that river, in Connecticut, are two hydro-electric plants that generate a large part of the energy used for lighting in Hartford.

From the doctrine of the Farmington and the Blackstone cases, it appears that every additional water power developed on the Farmington River, in Connecticut, may make more valuable, for purposes of taxation, the reservoir on that river in Massachusetts, and if the water power of the Blackstone Company in Rhode Island becomes more valuable for its use in that State, the value of the land, fall, dam and canal in Massachusetts will probably increase.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Commonwealth Edison Improvements.

Mr. Peter Junkersfeld, electrical engineer of the Commonwealth Edison Company, Chicago, addressed the noonday meeting of the Electric Club of Chicago, Dec. 9, on the recent extensions to the physical property of the Commonwealth Edison Company. He called attention to the fact that it is now about 20 years since the first Edison station was started in Chicago. Ten years ago the total capacity of the Chicago Edison Company stations was 12,000 kw. To-day the total capacity of the Commonwealth Edison Campany stations is 140,000 kw. He described the principal engineering features of the new Quarry Street station, stating wherein it differed from the Fisk Street station. These details can be found in the Electrical World of May 16, 1908, in the article on the Commonwealth Edison Company's system. The Quarry Street station is designed for a capacity of six 14,000-kw units, of which two are now installed. The total output of stations of the company has reached as much as 1,400,000 kw-hours per day. The connected horse-power of motors aggregates 113,000. The company employs 2300 regular employees. The last year about 750,000 tons of coal were consumed. Several times that much coal would have been burned if power had been produced in a number of isolated plants scattered over the city, as the economy would not have been so great, nor would it have been possible to burn this extra amount of coal with as little smoke as in the large station. The company is, therefore, relieving the streets of a large amount of coal traffic and reducing the amount of smoke. Of the output not delivered to railway companies, but sold for miscellaneous central-station purposes, about one-third is sold for power and two-thirds for light.

Single Fuel Burning at Salem, Mass.

The Salem (Mass.) Electric Lighting Company is one of the few central stations of its size in Massachusetts which burns a single brand of coal, instead of a mixture of fuels. In reply to a question why this practice obtains, General Manager S. Fred Smith states that while the company has made no special tests of the combustion of its fuel, Georges Creek coal, its experience has shown that it is better to use a straight coal than to go to the trouble of mixing the coal with cheaper fuels. Although the first cost of a mixture may be a little less, he believes that the ultimate increased expense on account of more labor and lower efficiency overcomes any advantage in buying the cheaper fuels. Mr. Smith feels that the smoke problem is also better handled with the straight Georges Creek coal, and while his station is near the residential section of this old and

aristocratic community, the company practically never has any complaint concerning smoke, and the percentage of ash obtained with the boilers is very low. The company uses Reagan grates under its boilers, and has obtained good enough results under its return tubular boilers to install these grates under four comparatively new 350-hp water-tube boilers. The production economy of the plant compares favorably with other plants of its size in the state.

Set-Back for Municipal Light Scheme in Mobile.

The city of Mobile, Ala., feels that it has solved the question of commercial and street lighting very satisfactorily for the next 10 years, and all talk of a municipal plant has disappeared. The municipal authorities are of the opinion that "it would be poor policy to engage in municipal ownership of utilities other than those which the city now owns." The arrival at this conclusion was hastened by the offer of the Mobile Electric Company to grant rates for general commercial purposes as follows:

	Gross. Cents.	Discount. Cents.	Net. Cents.
From 1 to 50 kw-hours inclusive	10	3	7
From 51 to 150 kw-hours inclusive	9	2	7
From 151 to 300 kw-hours inclusive	8	2	6
From 301 to 500 kw-hours inclusive	7	2	5
From 501 and upward	6.5	2	4.5

The minimum bill is $1.25. The Mobile company has also made a bid for street lighting for $57 per light per year on the all-night and every-night basis.

Advantage of Corporation Publicity.

In a paper read by President Jas. L. Richards, of the Boston Consolidated Gas Company, before the Massachusetts Street Railway Association, on Dec. 9, emphasis was placed upon the desirability of corporation publicity. President Richards stated that the desirability of publicity for public service corporations has been drilled into him from his own personal observation, notably in the improvement of the Boston gas situation since 1902. At that time the reputation enjoyed by the gas companies was not an enviable one. Within a very short time after Mr. Richards became connected with the company, petitions for lower-priced gas were filed and hearings held, and the question of municipal ownership was under consideration and advocated by some of the press and many of the aldermen and councilmen of the city of Boston. During the hearings for lower-priced gas President Richards invited the experts for the petitioners, Prof. Edward Bemis and others, to investigate the gas company's records and books, telling them that anything they wanted which the companies had they could have. The proposition seemed to surprise the opponents of the companies, but it was made in good faith, knowing that there was nothing to cover up, and that if all the facts were known the opposition would be greatly modified. The same proposal was made to the late Professor Parsons, who was the principal advocate of municipal ownership. The result was that within a comparatively short time the late Professor Parsons publicly stated that he did not believe that municipal ownership was a good thing for the city of Boston so far as the gas business was concerned, and it is doubtful if the company has to-day a firmer friend than Professor Bemis, who was the chief expert against it in the arguments for lower-priced gas during the consolidation period. Since consolidation the company has gone to a substantial expense each year to employ an independent auditor to audit its books, and to find out if all moneys have been expended legitimately. This information is made public so that every one of the 120,000 customers of the company can know all the facts regarding the important points of the business, as the company knows them itself. This method has been followed for a number of years, and while it has cost some money, President Richards says he considers it the best investment the company has ever made.

Sidelights on Central Station "New Business" Work.

By H. H. MacPherson.

In the so-called good old times when it was thought that a new-business department was unnecessary because people either did want or did not want to use gas or electricity, and that was the end of the matter, the real personal contact between the company and its consumers was limited to the small area occupied by the officers of the company. In fact, there were so many special rates in order to cover so many special conditions that no one but an officer of the company could have the special knowledge needed in furthering the commercial interests of the company.

During the period when it was coming to be recognized that personal representation, a good sales department and the consequent education of the public made the most paying kind of an investment for a gas and electric company, a few poor solicitors were put out upon a fixed salary to try to get new business. They were so hedged about with rules and regulations, and so handicapped with the conditions which grew out of the old specialty system, that most of their work consisted in saying, "I cannot say whether I will be allowed to do that or not, but I will see what the general manager says about it." Obviously such a method of procedure inspired neither ambition in the heart of the solicitor nor respect for the company's business methods in the mind of the prospective customer. Each experience of this kind made it appear more and more clearly that simpler rates, rules and regulations must go hand in hand with new-business solicitation, and that as the proper sort of men were found and educated, they must be given more and more latitude in every way that would make for ease and simplicity in dealing with consumers, thus becoming company representatives in the fullest sense of the word. Thus it appears that a properly accredited representative is the personification of an officer of the company to the consumers and prospective consumers in his district.

While this condition is the goal toward which every progressive company is striving, none of them has yet reached it, due mainly to the difficulty of getting the right kind of men and of training them to exercise such great authority.

A man who can sell gas and electricity, and all the appliances using either, might make a first-class representative in a residence territory and yet be almost a total failure in a business territory, primarily because in a residence territory he deals with women, while in the business territory he must handle cold, hard-headed "I-must-be-shown" business men.

In the progress of events a representative is sure to find in his work new conditions to which he must adapt himself. But never before has he encountered four such vital propositions all at one time as exist to-day with the new high-efficiency lamps, gasoline lighting plants, spectacular signs, and the readiness-to-serve rate.

To the representative falls a very large part of the task of maintaining the yearly increase in revenue. Of the four propositions just cited, three make fierce attacks on the revenue, and the fourth, while it builds up the revenue, requires a very heavy construction cost and is also very expensive to operate, thus limiting its field to large businesses. Moreover, most companies pay their representatives a small fixed salary plus a percentage of the increase in revenue—that is, if these new conditions wipe out the increase the representative draws no percentage.

However badly off the representative may be, the company is worse off because no increase virtually means no profits. If the company has spent thousands of dollars in educating the public to the use of the readiness-to-serve rate in connection with a certain standard of necessary light, the only way in which it can keep up its revenue in the face of the competition of high-efficiency lamps and of gasoline-lighting plants is to spend thousands more in educating the public to an even higher standard of lighting.

Fortunately the gasoline plants help to raise the lighting

standard because of the high intrinsic brilliancy of the lamps, although the electric company probably would much prefer to use its own methods of raising the standard of light. Then, too, the tungsten lamp and the latest forms of the inverted gas-cluster lamps are the finest kind of weapons for putting a quietus on gasoline competition. Hence, with proper handling and hard work the gasoline trouble should not last long enough to make serious inroads upon the revenue.

The tungsten lamp affords another proposition altogether. In the better class of business houses it will undoubtedly raise the standard of light, and increase the number of hours burning per day, with a consequent increase in the revenue from the very start. However, in the majority of business houses and in residences the natural method would be to replace the high-wattage lamps which are used for the greatest number of hours per day with tungsten lamps of the same or nearly equal candle-power.

Just as the carbon-filament lamp raised the standard of illumination and supplanted oil lamps for lighting purposes, so will the tungsten lamp raise the standard of illumination in supplanting other forms of lamps which are less efficient.

There is no question but that the tungsten lamp will eventually prove to be the best device that the central station has ever had as a business-getter and revenue-increaser. It is how to get through the next two years without a loss in revenue which is the burning question to all central-station managers.

No matter how many arguments pro and con there may be, there can be no doubt that in 99 cases out of 100 there will be a decrease in revenue from each consumer who changes to high-efficiency lamps unless the company is properly represented. It may happen that the company's representative will be unable to effect an increase, but he certainly cannot hope for an increase unless he is active in his company's behalf.

In every city there are a large number of business houses which formerly used electric light, but changed to gaslight—mostly to single Welsbach burners and to cluster lamps—in order to get more light for their money. Now that the tungsten lamp has cut the difference in cost between gas and electric light to a low value, many of these houses would be glad to rewire their places of business and use electricity again.

A great many small places of business have two-lamp, three-lamp and four-lamp electric fixtures with the lamps set in at an angle with the floor. Use is made of low candle-power carbon-filament lamps, hung as low as possible. In most of these cases a demonstration of tungsten lamps will result in an installation of them hung high and giving excellent illumination at only slightly increased cost for energy.

In the better class of stores there are many cluster gas lamps which will be displaced by tungsten lamps—some because they are unreliable in their operation, some because they do not give true color values, and others because they do not harmonize with their surroundings. In fact, there are innumerable places where the few large lighting units will be replaced by a large number of smaller ones.

In every city there are many stores which make their window outlining serve the double purpose of display lighting and window lighting. The electric company endeavors to supply as much of this window and display lighting on flat rates as possible, because only in this way can it assure itself that the lamps will be used as many hours as they should.

Since the arrival of the tungsten lamp there has been a great deal of complaint about the poor light given by this class of installation. In many cases the consumers substitute tungsten lamps at their own expense for the sake of the increased illumination thus obtained. While in most cases the change does not decrease the revenue, it is liable to result in trouble in signing up a new contract when the old one has expired. Only the most careful kind of handling of the consumer will prevent a decrease in revenue.

Under all the conditions which have been mentioned it is possible to increase the revenue and at the same time give the consumer better distributed light by keeping in touch with him, thus getting a chance to help him plan his installation.

Signs, outlines, windows, and especially spectacular or moving effects, are large and wholesome looking to the company and to the representative. "If you can't effect an increase on the inside, put some of the money saved by the consumer on the outside," is the slogan. Judging by some recent results the slogan is about right. When a business man sees the effect of the increased illumination upon his customer after he gets inside, he reasons that more light outside will draw other customers from his competitors.

The present development along the line of moving and spectacular effects is marvelous. The effect is not only noticeable along streets with many signs and much light, but merchants in locations hitherto not considered good are using animated signs to draw trade, the results being most excellent.

High-efficiency lamps, novel sign effects and the more general application of the readiness-to-serve principle in the matter of rates are just now starting the central station upon a career of much wider usefulness than ever before. Electric light, used for so many years on account of its enormous advantages in general application over other forms of illumination, is now cheaper than ever before. This lowered cost will cause its use to broaden in every field now occupied and to extend into others from which it has previously been barred.

A Handy Central-Station Chart.

By W. F. Kimball.

The graphic representation of costs and outputs for central stations has grown to be a very common practice. Where it is desired to show the variation of a single cost or output during a stated interval of time, graphic representation is a very simple matter. If it is desired to show the variation of several quantities, however, the problem becomes more difficult. For example, suppose it is desired to represent the variation from month to month of the station output, and also of the various items which make up the cost of manufacture in a central station. These items might be stated as (1) cost of coal delivered at boiler room; (2) labor in the station; (3) water, oil and waste, etc.; and (4) total cost. The central-station manager is interested to know the expense of each of these items expressed in cents per kw-hour. The writer was called upon recently to represent graphically these cost items, together with the station output, and attempted to do this on a single sheet using only rectangular co-ordinates. As the result was gratifying on account of its simplicity, a brief description of it may be of use to others.

A sheet of squared paper, having 20 divisions to the inch, was chosen for the plot. The size of the entire sheet is 8½ in. x 12 in. The squared area is 7½ in. x 10 in., which gives 150 divisions for the scale of ordinates and 200 divisions for the scale of abscissæ.

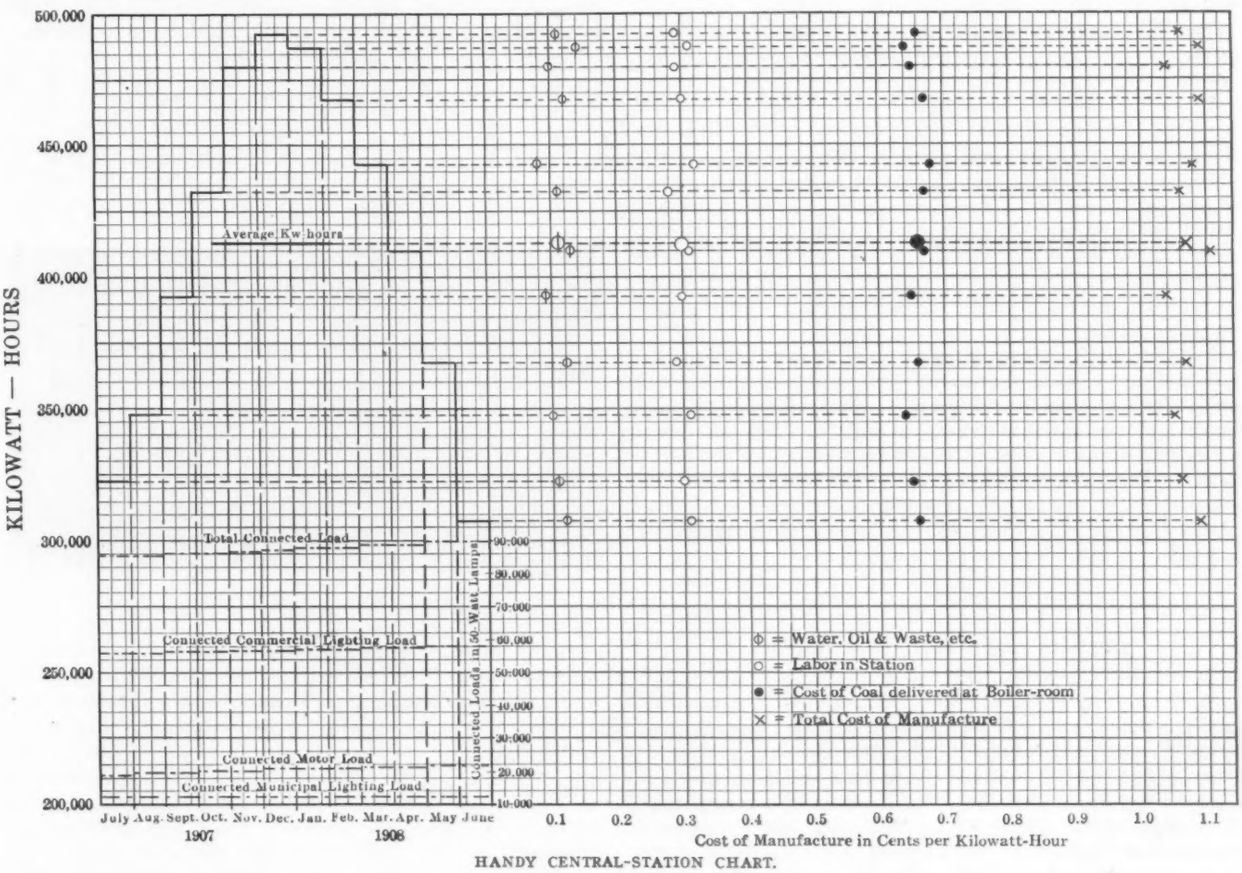
Starting at the extreme left of the plot, the first 60 divisions of the bottom scale are used for the 12 months of the year, five divisions for each month. The left vertical, or scale of ordinates, is laid off in kw-hours, starting a little below the lowest monthly output and extending high enough to include the maximum monthly output. A horizontal line is drawn for each month, giving the kw-hour output directly above the five divisions allotted to the month. The ends of these horizontal lines are then joined together by vertical lines, thus making a continuous plot. The vertical broken lines are merely to aid the eye in using the plot.

Starting at the sixtieth division on the bottom scale, the remaining horizontal divisions are made to represent cost of manufacture in cents per kw-hour. With the sixtieth division as zero cost, 10 divisions were allowed for each 0.1 cent. This arrangement gives a range in cost of from zero to 1.4 cents per kw-hour.

Dotted lines are then drawn horizontally across the chart as continuations of the 12 horizontal lines representing the monthly outputs. Along each of these dotted lines are plotted sym-

bols representing the different cost items for the corresponding months. Thus, suppose it is desired to find the cost of labor in the station for the month of October. The output in kw-hours for October will be found directly above the five horizontal spaces allotted to that month, and along the dotted continuation of this output line will be found the symbol representing the labor cost. This cost may be read in cents per kw-hour directly below the labor symbol, on the bottom scale. According to the chart herewith the October labor cost is 0.28 cent per kw-hour. Any convenient symbols may be chosen for the different cost items. The writer chose the ones given on the chart.

In case there should be two months for which the kw-hour output is the same, a different set of symbols might be used for the duplicate month. As a suggestion for this, one might use triangular symbols instead of circular ones for the first three cost items, and an X within a circle for the total cost. With this system it would be possible to make as many blue-prints of the chart as desired and still have a readily understood chart, whereas if the same symbols in a different color were used, a blue-print would be confusing.



HANDY CENTRAL-STATION CHART.

If desired, the averages for the year of the different cost items, as well as the average of the monthly outputs, may be added to the chart without causing confusion. On the example chart the symbols for average costs are made a little larger than the symbols for monthly costs.

By having a second scale of ordinates representing the total connected load expressed in 50-watt lamps, a curve of connected load may be added as shown. In fact, it may be possible to plot not only a curve of total connected load, but also curves showing connected motor load, connected commercial lighting load and connected municipal lighting load. These curves would show in very convenient form just where the greatest monthly gain in connected load was, besides showing the relative magnitudes of the different loads. It would seem that such a chart, if put in a conspicuous place in a central station, would be an incentive for better economy.

INTERIOR WIRING AND ILLUMINATION

The Wiring of Finished Residences.

The method of employing electrical service and wiring in newly built residences and apartment buildings is comparatively simple; for there are many classes of material which in a general way are equally suitable for use in new buildings, where it is not a difficult matter to place the wires in conduit. In the wiring of existing residences, however, an entirely different problem is presented, especially in such cases where the interior finishes and decorations are such as to make it undesirable to use such wiring systems as may deface or injure the interior finishes.

There are undoubtedly numerous dwellings throughout the country which are elaborately finished and which unfortunately were not equipped for electric lighting at the time they were built. Central-station companies also have electric light mains running through streets on which such houses are erected, and if the management of the electric light company could demonstrate to the owners or occupants of these dwellings that the buildings could be wired for electricity without injury or defacement to the interior decorations and finish, the knowledge would undoubtedly result in material benefit to both the lighting company and the occupant of the dwelling. It seems strange that an electric light company should run its mains to the outskirts of the city to connect up some new and isolated dwelling, when in the heart of the city and on the streets through which electric mains already run, and have run for years, there are blocks and blocks of houses which might be wired up for electric service if the matter were brought home to the owners in the proper way.

There are many electrical contractors throughout the country

who are skilled in the wiring or rewiring of existing buildings in such a way that it would be utterly impossible to determine that wires have been placed in a building except by means of small holes or openings back of canopies on ceilings and walls which are not visible when the canopy is in place. Flexible conduit or cable lend themselves very readily for such work and the resulting installation is first class in every respect. The flexible armored cable may possibly be found more convenient than the flexible conduit in most instances. The cable is sufficiently flexible for all practical purposes, the armor affords protection to the insulated conductors which it confines and in addition is so constructed that a gasket is employed between the inner and outer strips, making a practically water-tight enclosure for the insulated conductors. The exterior is smooth and the galvanized coating possesses certain anti-friction properties so that fishing is simple. In most cases it is not necessary to employ even the usual fish wire. In buildings already constructed, where armored cable may be used and where the conditions are such that neither outlet box nor plate can be installed as required in the Code, the inspection department having jurisdiction may permit the omission of these appliances if the armored cable is otherwise firmly and rididly secured in place.

Where permitted a concealed knob and tube system may also be installed, although this requires taking up boards in the floor. When it is impracticable to place the whole of the circuit on non-combustible supports of glass or porcelain, that portion of the circuit which cannot be so supported may be installed with conduit or armored cable. If the wires are not exposed to moisture they may be fished if separately encased in flexible tubing extending in continuous lengths from porcelain support to porcelain support, from porcelain support to outlet, or from outlet to outlet.

In addition to the concealed methods already mentioned there is also the method of running the wires on the surface of walls and ceilings in proper moldings of either wood or metal. The latter system has the advantage of low first cost and where appearance is not considered is just as reliable and serviceable as the other methods outlined. By using wood to match the finish of the rooms and by arranging the molding on ceilings in some design, the appearance of a room thus wired may be enhanced instead of lessened.

Arches in Michigan Cities.

In the Electrical World of Aug. 29 and Oct. 3, 1908, appeared articles relative to the arches which have been used on Canal Street at Grand Rapids, Mich., for down-town illumination. Following the example of its large neighbor, the little town of Big Rapids, which is also supplied with energy from the system of the Grand Rapids-Muskegon Power Company, has installed some arches which are still more significant to the electric lighting industry than are those at Grand Rapids, because they show to what extent it is feasible for small towns to undertake special lighting of down-town streets now that tungsten lamps are available.

Fig. 1 shows a view of the arches on Michigan Street, Big Rapids, at night. Each arch has 10 60-cp series tungsten lamps, operated from a 120-volt, constant-potential circuit. The arches are placed from 90 ft to 100 ft. apart. There are seven already installed and merchants are planning to install five more. This service costs the merchants about $4.20 per lamp per year, lamps burning three hours average per night. The street is about 60 ft. wide. This illumination compares favorably with that used in any of the larger cities of the country for special down-town street lighting. The cost to the merchants is about $42 per year per 100 linear feet of street, or $21 per year per 100 front feet.

The type of construction used is that of stretching a span wire from building to building and hanging the series tungsten lamps from this span wire in such a way as to have the appearance of an arch at night. The lamps and span wire are very unobtrusive by daylight, and the cost of installation is very much lower than that of the majority of special down-town street-lighting schemes. Most of the down-town street lighting in smaller towns has heretofore been very meager because of the great first cost of erecting special posts or because of the high cost of operation to produce a spectacular illumination with common carbon lamps.

Mr. H. W. Hillman, sales manager of the Grand Rapids-Muskegon Power Company, to whom we are indebted for the information in this article about this new work of his company, writes that in addition to the Canal Street lighting, Campau Square, joining Canal and Monroe Streets, which is about 175 ft. x 175 ft., has been illuminated with 51 60-cp, series tungsten lamps, hung from spans in the same manner as on Canal Street.

On Monroe Street, which is about 80 ft. wide, and which leads from Campau Square, 12 arches have been erected about 88 ft. to 90 ft. apart. Fourteen lamps are operated in series on each arch from 240-volt, constant-potential mains. Tungsten lamps are used the same as on Canal Street. Five more arches are about to be installed on Monroe Street, after a trial of the first 12, and it is believed that the appearance of the street will be very much improved by this addition. Merchants on many other streets are talking of this kind of illumination in Grand Rapids, some of the streets being in outlying districts. The low first cost undoubtedly has much to do with the popularity of this system and the rapidity with which it is spreading through Grand Rapids as well as in other Michican towns.

ARCH ON MICHIGAN STREET, BIG RAPIDS.

Mr. Hillman, regarding this work, says: "I attach importance to all of this work, because when installations of similar character have been made heretofore in other cities, they have mostly been expensive installations and confined to one main street. The value of this method of lighting lies in the low operating cost and the low initial cost of the arches, combined with the beautiful, illuminated-canopy effect. The method seems to possess all the factors to make the system generally popular. A comparatively large business is, therefore, created, as against a small and special class of business known heretofore. The effect upon the industry with this method is more marked than ever before."

He states that this method is being considered by many other cities and towns in Michigan, and the effect will no doubt be felt in other states. By this method of lighting between 60 kw and 70 kw per mile of street is required. On Division Street, in Grand Rapids, where this same method is being talked of, even a larger amount of energy than this is planned. Mr. Hillman calls attention to the fact that with this method of lighting a narrow street can be apparently widened by forming the arch from building to building, rather than from curb to curb. Therefore, the most popular method for a narrow street would be an arch from building to building.

Care must be used in suspending lamps from the span wires to produce an even arch effect. The necessary raising or lowering of a span wire because of some window or other obstruc-

tion will throw the lamps out of alignment, unless an allowance is made by lengthening or shortening the supports of each lamp.

Another point about which care must be exercised is in turning corners from one street to another, where streets run into each other diagonally. For example, in Campau Square in Grand Rapids, which is formed by the intersection of several streets, it was found that a most confused appearance would be produced unless the alignment of the arches from the approaching streets was maintained clear through to the turning point, the turn being made at a sharp angle rather than by a gradual curve. With these precautions as to the alignment, the results are pronounced very satisfactory.

The town of Greenville, Mich., the population of which was 3421 in 1900, has ordered six arches somewhat like those at Big Rapids, and five or six other small towns in Michigan are taking up the matter actively.

New Telephone Patents.

IMPROVEMENT IN ARRESTER BARS.

It has been customary in mounting protectors upon their mounting bars for use in distributing frames to mount them in pairs, those to the left of the arrester bar corresponding to one side of the line and those upon the right to the other side of the line. It will be seen that, unless there is some provision to the contrary, this would mean that the line wires must so approach the arrester that one of the pair must be soldered at the right of a bar and the other at the left, and similarly for the cross-connection bars. In order to avoid this, Mr. C. A. Simpson, of Chicago, has patented an arrangement wherein auxiliary terminal springs are included in the assembling of the arresters and metal cross-ties are made from these to the springs in such a manner that the proper terminals for both the line and the cross-cut pair are on one side of the arrester bar.

SWITCHBOARD CIRCUITS.

For practically all types of central-energy relay switchboard heretofore designed at least one relay is assigned to each individual line for control of signals and, in many instances, two

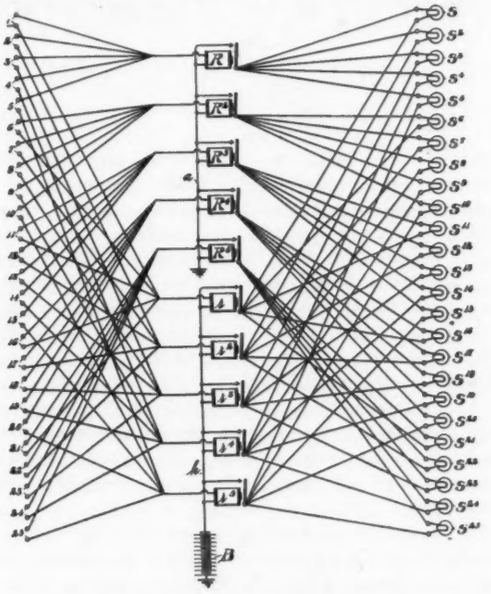


FIG. 1.—WEBSTER TELEPHONE SYSTEM.

such relays are required. This, of course, results in a large number of line relays, which are quite an expensive part of the equipment. In order to reduce the number of relays, Mr. H. G. Webster, of Chicago, places the control of each signal in the combined action of two relays, it being necessary for these two relays to act in co-ordination. For example, if use is made of two groups of line relays of five each, by using each one of one group once with each of the five of the other group, these 10 relays may be made to control 25 signals. The arrangement may be better understood from Fig. 1, in which the lamp *S* is controlled by the combined action of relay *R* and relay *r*; similarly, lamp *S2* is controlled by the combined action

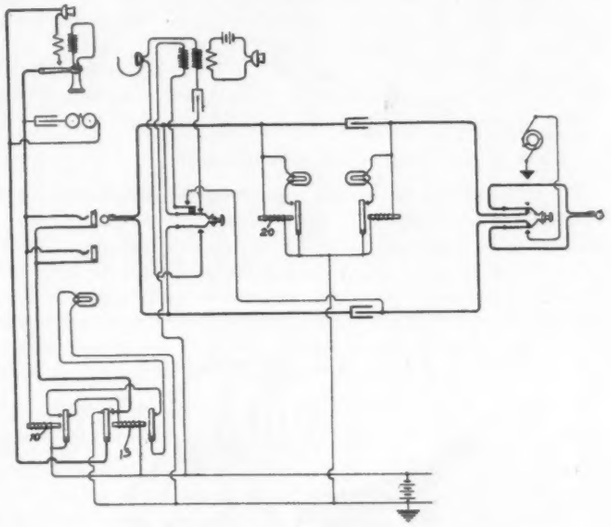


FIG. 2.—CORWIN SWITCHBOARD CIRCUIT SYSTEM.

of relay *R* and relay *r2*. Mr. Webster has assigned his patent to the Kellogg Switchboard & Supply Company.

In Fig. 2 is shown a switchboard circuit system, patented by Mr. E. R. Corwin, of Chicago, and assigned to the Monarch Telephone Manufacturing Company. The most novel feature lies in the cord circuit, wherein the tip side of the cords are free from the battery, while the sleeve sides are connected through a single relay to control the supervisory lamp. After a plug has been inserted in the jack the energy is supplied to the supervisory circuit either through the cut-off relay 13, or through this cut-off relay to line relay 10 in parallel. The circuit of the line relay 10 is controlled entirely by the subscriber's switch-hook. The relays are so proportioned that the supervisory relay will fail, except when the two other relays are feeding energy to it in parallel. The action of the circuit in displaying the line signal and the cutting of it from the circuit upon the response of the operator are readily traced.

ANTISEPTIC DEVICE.

Mr. J. W. McBrine, of Medford, Mass., has patented a pocket antiseptic device for telephone transmitters, consisting of two metal rings, adapted to fit together, after the manner of the ordinary embroidery rings. One of these rings has lugs which will engage the lips of the transmitter mouthpiece. In use, a piece of thin paper is clamped between the rings and the attachment is then pushed over the face of the mouthpiece.

COMBINED TELEPHONE AND FIRE ALARM SYSTEM.

There have been many suggestions in the past for the combining of the telephone service with automatic burglar alarms, fire alarms, etc. A patent has been issued to C. E. Buell, of North Plainfield, N. J., for a telephone system adapted to operate in connection with an automatic sprinkler system. The apparatus is so designed that in case of a lowering of pressure in the sprinkler system stand-pipe, due to the opening of any of the sprinklers, a number signal will be sent in on the telephone circuit associated with it. In the working out of the system the lowering of the pressure causes the admission of a water supply to a water motor, which, in turn, operates a generator and a make-and-break device; these two together furnishing the current impulses to determine the number sent in on the telephone. The system also contemplates signals for indicating any tampering with the main valve.

TELEPHONE SUBSTATION SET.

An all-metal substation telephone set forms the subject of a patent granted to Mr. J. A. Birsfield, Chicago. Mr. Birsfield's patent has been assigned to Alfred Stromberg, of Chicago. The set comprises three main parts—a base piece, carrying a longitudinal central groove for the wires; a box body, adapted to be screwed to the base piece by lugs at the top and a single clamp screw at the bottom; and a door piece. All of the parts of sheet steel are specially formed so as to fit together in a simple manner and yet to provide the required mounting lugs and openings for accommodating the complete apparatus of the special types for which the case is designed.

SIMPLIFIED TRANSMITTER.

It would seem as though the limit of variety should have been reached for transmitters, but, nevertheless, new styles are continually being suggested. The last to appear is the invention of W. Kaisling, of Chicago, and in it the whole microphone apparatus is mounted upon the diaphragm. Referring to Fig. 3 it will be seen that the stationary electrode is mounted at the

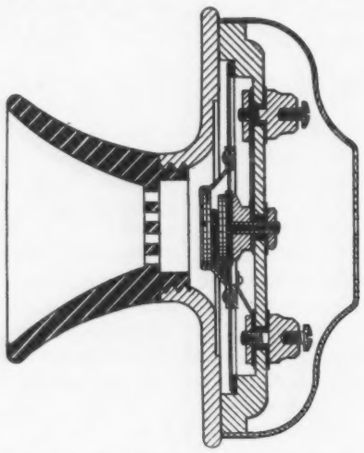


FIG. 3.—KAISLING TELEPHONE TRANSMITTER.

center of the diaphragm, its stud being so clamped that the middle point of the diaphragm has no motion. The flat, conical cup carrying the second electrode has its rim riveted to the diaphragm approximately at the point of maximum amplitude of vibration. The second electrode is, therefore, moved toward and away from the stationary one.

RELAY.

A double-acting relay, sufficing in lieu of two relays, that is, a cut-on and cut-off relay, forms the invention of Mr. W. W. Dean. This relay has two coils and two cores, lying in parallel lines. A single armature is pivoted with one of its extremities respectively confronting each pole. When one coil is energized it moves the armature from its normal back-stop and closes the relay contacts; when the second coil is energized, its pull overcomes that of the first, and forcibly returns the armature to the back-stop, thus cutting off the contact. It will readily be understood that this relay will serve as a line and cut-off relay, or as a supervisory control relay. The patent for the use of it is assigned to the Kellogg Switchboard & Supply Company.

TELEPHONE REPEATER.

Mr. J. H. Christensen, of Denmark, has obtained a patent for a repeater. This consists of a receiver with diaphragm in a vertical plane, and carrying a carbon-plate electrode. A long edge of carbon is presented to this plate, being supported by a counterbalanced pendulum rod. The pendulum is arranged so that the normal contact is very light. The pendulum is supported by a shaft journaled in jewels. Behind the jewels is mercury in contact with shaft ends to complete the electrical circuit through the contact piece, thus forming the transmitting part of the repeater.

LETTER TO THE EDITORS.

Letter-Telegram Service.

To the Editors of Electrical World:

SIRS:—The announcement reported in your columns that the French government has established a letter-telegram service marks an important forward step in electrical correspondence and in line with what has been under contemplation in this country for many years and recently put in practical operation between Boston and Portland, Maine.

In France letters are to be transmitted at the rate of five words for a cent during the night, for delivery in the morning. The wonder is that idle wire facilities during the night have not been utilized long ago, especially in countries where the telegraphs are operated by the government and where the aim has been to give the best service on a barely self-sustaining basis of earnings.

In some countries the telegraphs have been designedly carried on at a loss, self-support being the signal for a reduction of rates, or improvement of the service by underground duplication of overhead lines and routes. Germany, England and France have supplemented pole lines to all important cities by substantial underground construction, which insures communication at all times regardless of storm. It is highly probable other European countries will follow France's example and the letter-telegrams will, in Europe, become international, and later on when the carrying capacity of wires is fully utilized by adoption of improved methods of operation, letter-telegrams will not be confined to the night, but sent at all times at the rate of five words for a cent and yield a liberal profit.

In this country, where the telegraphs are conducted not for the benefit or convenience of the public, but solely in the interest of private owners, conditions are entirely different. Of course, it cannot be expected that a share corporation should carry on its business on a philanthropic basis, but nevertheless, it is reasonable that the public should claim the best service and fairest rates warranted by improvements in methods of operation.

Practical monopoly of rights of way over railroads, public thoroughfares and through underground conduits by a private corporation has yielded no return of appreciative acknowledgment of these valuable privileges; on the contrary, they have been used to entrench and fortify against development of telegraphy and for perpetuation of exclusive control which stands for repressive censorship of all efforts for improvement. With the private telegraph monopoly in America it has never been a question of how to extend and cheapen the service, but how to safeguard its narrow limitations.

The letter-telegram was inaugurated in this country two months ago, with four classes of service, as follows: The message delivered by the postoffice, 10 words for 10 cents; delivered by messenger, 25 words for 25 cents; delivered to the postoffice, 50 words for 25 cents, and delivered by messenger, 100 words for 25 cents. In this last case the letter is filed with the telegraph company already perforated on a tape, and the received message is delivered on a tape in Morse characters for transcription by the correspondent. Perforating machines are rented at a small rate and as they are of the standard typewriter keyboard pattern anyone can perforate. Transcription from the Morse code can be mastered in a few days. Letter telegraphy in this country will from present appearances have to wait upon the progress of this new company with a new method of operation and a new conception of what the times and state of the art owe to the public.

In extenuation of a recent increase in rates the Western Union Company stated that the Morse operator had been deteriorating in efficiency for many years until now his average usefulness is only about one-half what it used to be, or. telegraphically, nine words per minute. It may be that the steady reduction of the operator's pay in the face of constantly

increasing cost of living has something to do with this decline in earning capacity. Be this as it may, and with the operator even at his worst (for none will own to this rating), a duplex wire could be made to earn $51.84 gross in 25 hours at the French rate of five words for a cent—assuming, of course, that the date, address and signature of each letter are included in the count. Allowing 65 per cent of this amount for labor, which is not far from estimates given out by the companies, a wire would net $28.15 per day—against which, of course, maintenance of lines, administrative and other expenses would have to be charged. This is sufficient to show, however, what could be done if the companies were disposed to open the opportunity for general telegraphic correspondence instead of neglecting the enormous facilities of the night lest the public should avail of the low rate to a degree which might interfere with the high rate during the day.

Reports of the Western Union Company show that there is a profit of between three and four cents in each message, that the volume of yearly business is about stationary, and that the efficiency of the operator is declining. The operator contends that his pay is growing less, his hours no shorter and employment more uncertain—a poor prospect for the letter-telegram by the old companies.

The French government is better equipped for the new service than the American companies. It uses the ordinary Morse, the Wheatstone and the Baudot printing system, and labor is cheaper. Undoubtedly the new departure will meet with success.

The next few years will bring important changes in telegraphic and postal communication locally and internationally. Two-cent postage with England is only the beginning of its universal adoption. The two-cent-a-word cable rate is coming and the telegram-letter at the rate of five words for a cent, night or day, between all points in the United States, will be realized before long.

To restrict the facilities of a telegraph wire to manual Morse transmission and fix rates accordingly, when the wire is capable of delivering 1000 words per minute, is not progressive.

NANTUCKET, MASS. PATRICK B. DELANY.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Separation of Stator Losses in Three-Phase Motors.—H. ZIPP.—The author has formerly discussed the sudden change of the hysteresis loss in the rotor of a non-synchronous motor at synchronism and has discussed the way in which the hysteresis angle and the eddy-current angle depend on the frequency. While the eddy-current angle decreases to zero with decreasing frequency, the hysteresis angle remains constant if the magnetic flux density is not changed. The author now shows that this fact affords a simple means of separating the hysteresis and eddy-current losses in alternating-current circuits containing iron. The author shows in detail how to separate by this method the iron losses in the stator of a three-phase motor.—*Elek. und Masch.* (Vienna), Nov. 8.

Repulsion Motor.—R. GOLDSCHMIDT.—The first part of a paper in which the author discusses the theory of the repulsion motor. After dealing generally with the current in the armature, the author details the various peculiarities of the repulsion motors, due to Elihu Thomson, Latour, Winter and Eichberg respectively. The methods of operation of, and the determination of the losses in, the types are discussed at length. The paper is to be continued.—Lond. *Electrician,* Nov. 27.

Lamps and Lighting.

Quartz Mercury-Vapor Lamp.—This lamp, which has been described in detail in ELECTRICAL WORLD, in its latest form has the following construction: The quartz lamp is a mercury-vapor lamp in which the arc is surrounded by a transparent quartz tube from 3 in. to 6 in. in length. At the ends of the tube are placed quartz receptacles which contain the mercury electrodes. These receptacles are surrounded by fan-shaped coolers of copper, by means of which the heat radiation and the strength of the current are regulated. The burner is attached to a metal plate, *A*, which carries a reflector placed above the tube. By means of the pivots placed at the end of the metal plate a burner is attached to the supports provided in the lower part of the lamp casing, so that it can turn. An operating rod, *U*, which is suspended from the upper part of the lamp, is allowed to hang down through the loop *Y* attached to the metal plate. A shunt-wound magnet, *Q*, is placed in the center part of the lamp casing, and the previously mentioned operating rod, *U*, is attached to the armature arm of this magnet. On the plate above the electromagnet *Q* is placed a cylindrical choking coil, *L*, surrounded by a "rheostan" resistor, *M*. Around this latter, six iron resistors, *H*, enclosed in air-tight glass cylinders, are fixed, these resistors being connected in parallel with one another, but in series with the rheostan resistor, the choking coil and the burner, whereas the shunt-wound magnet *Q* is connected in parallel with the burner. The choking coil *L* serves to prevent the lamp from being extinguished should the voltage fall suddenly. At its lower end it carries an iron piece, *N*, projecting sideways, which is placed opposite to a small movable iron piece, *O*. This iron piece lies in the circuit of the shunt-wound magnet *Q* and breaks the same at *P* as soon as it is drawn up from the iron piece *N* by the choking coil. When the lamp is switched in, no current passes through the burner itself, owing to the fact that there is no connection between the mercury electrodes, the current passing instead through the electro-magnet *Q*, connected in parallel with it. This latter draws up the armature *R*, and by

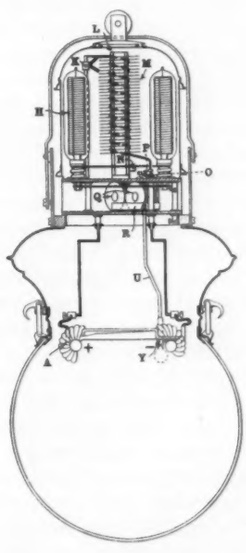


FIG. 1.—SECTION VIEW OF QUARTZ MERCURY-VAPOR LAMP.

means of the operating rod *U* tilts the burner on its axis, so that the mercury can flow from the positive to the negative electrode receptacle. The current now set up magnetizes the choking coil *L*, which immediately attracts the iron piece *O*, and consequently interrupts the circuit of the shunt-wound magnet *Q*. The latter, therefore, releases its armature *R*, the burner returns again to its former position of rest, and an arc is now formed in the tube as the mercury flows back from the negative to the positive receptacle. Shortly after ignition, the burner absorbs approximately only 30 volts, and, therefore,

gives very little light. Its full voltage (85 volts to 90 volts for 110-volt lamps, 165 volts to 185 volts for 220-volt lamps) is first attained when the electrode receptacles are thoroughly warmed, and then the full brilliancy is reached at the same time. The warming of the electrode receptacles and the increase in brilliancy will take place more rapidly the higher the current is, as the latter will flow through the burner from the beginning. On this account iron resistors in a hydrogen atmosphere like the ballast resistors of the Nernst lamp are used in series with the burner. The rheostan resistor M is provided with a sliding contact, K; if this is moved upward, the resistance is increased and the burner voltage will be reduced. The lamps may, therefore, be used without further alteration for high pressures (up to 220 volts for 120-volt lamps), if the sliding contact of the rheostan resistor is moved to its highest point. Since the light of the lamp is rich in ultraviolet rays, the lamp must be used with a glass globe which entirely absorbs this kind of rays. "These rays possess insect-killing properties, and are found to destroy all flies, moths, mosquitoes, etc., coming within their range. When used for the above purpose, however, the lamps are supplied with a different form of globe. The color of the light emitted is rather less bluish than the light of the ordinary mercury-vapor lamp, but is nevertheless far from pleasant."—Lond. *Elec. Eng'ing,* Nov. 26.

Temperature Fluctuation in Alternating-Current Lamps.—H. Ebeling.—An account of an experimental investigation of the temperature variation in wires through which an alternating current passes. He first assumes that for the loss of heat Newton's law holds good, but this is not the case. As a matter of fact the loss of heat is proportional to T^b where T is the absolute temperature and b is different from unity. Further, the loss of heat is not proportional to the surface, but is proportional to the length and inversely proportional to the radius of the wire. For platinum wire in air and in other gases the exponent has the same value, namely 1.25, for all gases at atmospheric pressure; b changes essentially with the atmospheric pressure. The author has made experiments with carbon, tantalum and osram lamps. Temperature measurements were made with a Wanner pyrometer and the resistance was determined from voltage and current; it was then possible to plot the resistance graphically as a function of the temperature. The curves are practically straight lines. By means of the oscillograph the variation of resistance was then determined with alternating current and from this the author found the variation of the temperature by means of his resistance-temperature curve. The carbon lamps show only a slight variation of temperature, while there is a very large variation of temperature in metallic-filament lamps. This the author considers to be a chief reason for the shorter life of metallic-filament lamps operated with alternating current instead of direct current. On account of the method of suspensions of the metallic filament, these considerable rapid temperature changes should produce severe mechanical stresses.—*Ann. der Phys.,* No. 12.

Compound Filament.—A note on a recent British patent (8416) of the Wolfram-Lampen A. G., referring to metallic filaments with an inner core of sintered niobium, osmium, vanadium, thorium, titanium, or zirconium, or alloys of these metals, and a coating of tungsten. Such filaments can be sintered to a higher degree than a pure tungsten filament, and are therefore stronger; they have also a high specific resistance, and according to the patent can be run at 0.5 watt per candle without a blackening of the bulb. The process of manufacture is to coat a filament of carbon and one or more of the above highly refractory metals with a tungsten paste. The whole is then sintered together and the carbon is expelled in the usual manner. The porous internal structure obtained causes the filament to have a very high specific resistance.—Lond. *Elec. Eng'ing,* Nov. 26.

Generation, Transmission and Distribution.

Cheap Energy.—E. A. Ashcroft.—A paper on the influence of cheap electric energy on electrothermic and electrolytic industries. The author gives some average figures on the relative cost of electric energy from steam, gas, oil and water. His figures for the horse-power-year are $31.51 with steam engines; $26.28 with oil engines; $25.55 with gas engines; $19.47 with water power, "class 2"; $7.30 with water power, "class 1." With respect to the two classes of water powers the author distinguishes between those powers where a high cost of regulation or of development is necessary to bring the water to the place of consumption and to insure an even supply all the year round, on the one hand, "class 2," and those cases where these essential objects have been provided more or less completely by natural conditions, "class 1," thus rendering the total capital employed much lower. The author gives detailed information concerning the cost of a particular Norwegian water-power development where the fall has a capacity of 7500 kw and the contract for running 6000 kw is at an inclusive charge of $12.17 per kw-year delivered at the switchboard or $9.12 per electric hp-year. This is selected as a probable minimum, although there have been cases in Norway where the prices have been still lower; "for instance, at Meraker, near Trondhjem, 3000 hp has been sold at $6.20 per hp-year on a seven-years' contract, and at Notodden the price was $6.81 per hp-year for 3000 e.h.p." It is by no means certain that there is a very large number of water powers which can be developed at even so low a cost as to permit of the sale of energy at $10 per hp-year, either in Norway or anywhere else.—*Transactions Faraday Society,* October (Vol. 4, Part II).

Water Power.—H. von Schon.—The author has discussed in former articles the possibility of tripling the present available water power by a systematic program of water storage, and has claimed that the power thus rendered available would be used quickly for the rapid development of many industries. He now endeavors to substantiate these various propositions by analyzing some typical cases of rivers as to their present water-power status and the development of the obtainable conditions and their influences, by a discussion of practical conservation programs.—*Eng. Mag.,* December.

Brakes.—H. A. Steen.—A paper on electrically operated brakes for industrial purposes, especially for cranes, hoists, electrodes, etc. In the first part of the paper the author discusses electro-responsive releasing devices in the following order: Direct-current magnets (series, shunt, compound); alternating-current magnets, turning-armature magnets, and motors. A method is shown for calculating the kinetic energy which the brake is called upon to consume. The author then discusses friction materials. The materials most frequently used are cast iron, steel, brass and bronze, and for linings and inserts, maple, oak, ash, cotton wood, lignum-vitæ, fiber, cork and leather; the lining must be carefully selected. Cast iron on cast iron is stated to give very good results, but bronze on cast iron is also good and is much used, especially for disk brakes. The coefficient of friction of soft cast iron on cast iron has been found to average about 0.32; the coefficient varies with the pressure and speed, but is not influenced by temperature within practical limits. The author finally discusses the different types of brakes, namely, shoe brakes, band brakes, and axially applied brakes, giving diagrams and in some cases formulas.—*Proc. Eng. Soc. of Western Penna.,* November.

Regulation of Rolling-Mill Motors.—A. Heyland.—His system, described before in the Digest and called by him a "modified cascade system," has been formerly proposed by him for hoists, elevators, etc. He now says that the same system may be used also for speed regulation of rolling-mill motors, etc., and that besides automatic voltage regulation, an equalization of the load curve is obtained so as to avoid any serious reaction of sudden heavy overloads upon the supply system.—*Elek. Zeit.,* Nov. 19.

Electric Power in Rolling Mill.—F. Collischonn.—An illustrated description of a rolling mill which was formerly driven by a 2000-hp gas engine, running at 100 r.p.m., but the latter was not able to withstand the occasional heavy overloads. For this reason an electric motor has been coupled with the gas engine, its size being so chosen that it can carry the load alone

without the gas engine if necessary. Some details of the construction of the motor are given.—*Elek. Zeit.*, Nov. 26.

Traction.

Third-Rail.—A full report of the committee on standard location of third-rails of the American Railway Association. The report gives figures representing the practice now in vogue.—*Elec. Railway Jour.*, Dec. 5.

Mail Trolley Cars.—J. NERCHE.—An illustrated description of trolley cars used in German cities for transport of mail and packages.—*Elek. Zeit.*, Nov. 26.

Installations, Systems and Appliances.

Ballast Resistors for Avoiding Sparks at Breaking a Circuit.—M. KALLMANN.—A paper read before the Berlin Electrical Society. The author has formerly shown that the familiar ballast resistor of the Nernst lamp (iron wire in an atmosphere of hydrogen in a glass globe) may be employed for a great many purposes—for starters, for short-circuit brakes, for a comparison watt, etc. In the present paper he describes their use for preventing the spark due to self-induction in opening a circuit. These ballast resistors are called by the author "variators." In practice the electromagnet of a motor or of a generator of ordinary construction, on being suddenly disconnected, may be subjected to 10 times the normal voltage for a portion of a second on account of the e.m.f. due to self-induction. The scheme by which the closing or breaking of a circuit is carried out in four steps is indicated in Fig. 2. *V* indicates three variators and *M* is the magnet winding. In position I the circuit is broken, the contact *z* being open. In position II the contact *z* is closed, while the magnet *M* is still short-circuited. The full

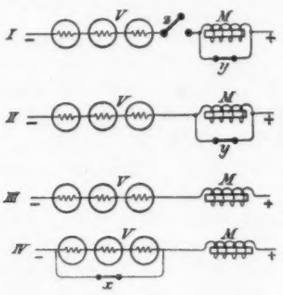


FIG. 2.—BALANCE RESISTORS.

e.m.f. of, say, 440 volts is therefore impressed on the variators *V*, which may now permit a current of 0.25 amp to pass. In this position the variators *V* are incandescent. By opening the contact *y*, the magnet winding *M* is connected in series with the variators in position III, in which the current is still almost 0.25 amp, but the incandescence of the variators is less than in position II; 215 volts are now consumed by the variators and 255 by the magnet winding. Finally, by short-circuiting the variators *V* by closing the contact *x*, the whole voltage is impressed on the magnet winding *M* and the current is over 0.5 amp. During the four steps the current is therefore gradually increased. For breaking the circuit the succession of the four steps is exactly the reverse. The author describes a switch based on this principle and operated by hand, and also describes an automatic switch based on the same principle.—*Elek. Zeit.*, Nov. 19.

Load Factor and Diversity Factor.—W. W. LACKIE.—An account of his address to the Glasgow section of the (Brit.) Inst. Elec. Eng. Load factor is the ratio of the average load, represented by the actual sales to consumers, to the maximum load supplied to the feeders at the station, expressed as a percentage. Even if all the consumers had a steady 24-hour load, the load factor as thus defined could not be 100 per cent, for the average load represented by the number of units sold divided by 365 × 24 includes the losses in distribution, and these may be a considerable percentage, especially in the case of alternating-current transformer systems. The diversity factor is the ratio of the sum of consumers' maximum demands to the maximum demand on the feeders at the station busbars. It is thus always greater than unity, although there can be a hypothetical case in which the consumers' maximum demands might occur simultaneously, in which case the demand on the feeders would be greater, as it would include the distribution losses, so that in this instance the diversity factor in accordance with the accepted definition would actually be somewhat below unity. Last May there were 3583 motors connected to the Glasgow Corporation mains used for 113 different trades or purposes. The load factor for all of the 23,748 hp was 38 per cent. The lowest load factor was found in the butchers' trade and was 9 per cent. The highest was in iron works and amounted to 26 per cent. "A fair method of charging would be some such figure as $30 per kilowatt of maximum demand for lamps and $20 per kilowatt of maximum demand for motors, plus the cost of coal and other supplies per kw-hour. To meet the lighting consumers' convenience in Glasgow the $30 is divided up into 730 equal payments, and in the case of the motor user the $20 is divided into 1000 equal payments, but if a set of consumers do not use their maximum demand for 730 and 1000 hours respectively, they do not pay all of their standing charges and are, therefore, a loss to the undertaking notwithstanding the fact that throughout they have to pay the higher or initial rate under the maximum demand system. In other words, a consumer paying the maximum charge per kw-hour (say, 12 cents or even 16 cents) may be an unprofitable consumer, while an industrial user paying 1.5 cents per kw-hour throughout for a long-hour supply will make a solid contribution to the profits of the supply undertaking." The motor load is practically uniform without a peak for nine hours a day and 300 days in the year; while the lamp load has a very pronounced peak for about two hours in the winter afternoons. At present many English companies and supply authorities in supplying energy for motor purposes allow their consumers to use 5 per cent or 10 per cent, and in some cases 20 per cent of their consumption for lamps, the whole being charged at motor rates.—Lond. *Elec. Eng'ing*, Nov. 26; Lond. *Electrician*, Nov. 27.

Electrical Industry in Great Britain.—W. M. MORDEY.—In his presidential address to the (Brit.) Inst. Elec. Eng. the author gives a comparison between the condition of the electrical industry of England, as indicated by the statistics and returns relating to electricity supply, with the electrical industry elsewhere, particularly in Germany. He shows some tables giving the average consumption in kw-hours per inhabitant and the average price per kw-hour paid, and other figures for representative towns in both England and in Germany. From these figures the conclusion is arrived at that in the large towns in Germany electrical energy costs twice as much per kw-hour, and the consumption per inhabitant is half as much as in large British towns; further, in the medium-sized and small towns in Germany, although the consumption per inhabitant appears to be about the same, the price per kw-hour is over 30 per cent higher than in the corresponding British towns. Further, the equipment of the generating plant in all the public supply stations in Great Britain is about two and a quarter times as much per inhabitant as in Germany, and in the relative statistics with regard to tramway work, England does not compare unfavorably. With respect to several towns in Europe, which obtain their supply from large water-power stations, figures are quoted to show that the lowest of the average charges made in these towns is higher than the average price obtained in Bolton, which is 2.36 cents per kw-hour; Lyons comes second with an average price of 2.54 cents per kw-hour. In conclusion, Mordey insists that the alleged backwardness does not exist in England and that there is no justification for the statements about their scientific and technical education being behind other countries.—Lond *Electrician*, Nov. 27; *Elec. Eng'ing*, Nov. 26.

Domestic Electricity Supply.—W. R. COOPER.—A paper read before the (Brit.) Inst. Elec. Eng. The author considers the importance of so adjusting tariffs that electric heating and cooking may be encouraged. Nearly all present-day tariffs are useless for this purpose. The essentials of a tariff for domestic supply are laid down, and tariffs based on rateable

value, on two-rate meters, and on the total "wattage" of the lamps installed are considered. Preference is given to the latter, in which a certain sum per year is charged per equivalent 8-cp, 30-watt lamp, plus a small charge per kw-hour. It is shown that this charge may very well vary from 1.5 cents to 2 cents per kw-hour. Finally, the economic aspect of electric heating and cooking is considered in some detail. The paper is to be concluded.—Lond. *Electrician,* Nov. 27.

Commercial Electric Heating.—J. Roberts.—A paper read before the (Brit.) Inst. Elec. Eng. Electrical heating on a commercial scale cannot be realized until the present methods of distribution are altered. The employment of single-phase alternating current with house-transformers is suggested for the purpose, and low pressure—50 volts—for both heating and lighting is a necessity. More care must be paid to the design of heating apparatus, and a new arrangement for this purpose is described. Success cannot be achieved "unless energy for cooking requirements costs less than 2 cents per kw-hour. The maximum demand system cannot be tolerated. A separate heating circuit is impracticable in requiring two meters, and further, it is impossible to prevent a consumer connecting a length of cord from his cooking circuit to a lampholder, withdrawing his main lighting switch and doing all his lighting at the cooking rate. A time-switch for changing over the meter at a certain hour is another scheme which must be rejected, if only on the score of initial expense and cost of maintenance. It seems that the only way is to adopt what is known as the Norwich system. Fix a minimum figure, depending upon the rateable value of the premises, and charge as much below 2 cents per kw-hour as possible." The total failure of the present practice requires, according to the author, revolutionary methods.—Lond. *Electrician,* Nov. 27.

Municipal Tramway and Lighting Plant.—A note on the results obtained in Frankfort, Germany, with municipal tramway lines and with their lighting station. The municipal tramway lines at the close of the fiscal year 1907 had a length of 38 miles and carried during that year 74,250,000 passengers. There are 612 cars for the passenger service and the total number of employees is 2124. On the average the electric cars run over 30,000 miles per day. Though the fares are lower than in American cities—the ordinary fare being 2½ cents—yet the net profit derived from the service turned into the treasury was $312,970. The profit realized during the year by the city from its electric lighting plant aggregated $400,200.—*Elec. Railway Jour.,* Dec. 5.

Storage Battery and Booster.—A. Neimke.—Those cells in a storage battery which are next to the battery switch and which are used only for making up the voltage drop in the feeders at times of high load, are not being discharged at periods of low load, while they are regularly fully charged. In order to keep them in good condition it is necessary to provide for their regular discharge and the author describes an arrangement in which these cells are used to drive the booster as a motor, while the two motors which otherwise drive the booster and which at the same time act as balancers on the two sides of the three-wire system give off energy to the network.—*Elek. Zeit.,* Nov. 26.

Electric Light from Wind Mills.—An illustrated description of the Oerlikon system of electric lighting stations, the power being derived from a wind mill. The special features of the Oerlikon system with respect to regulation of the voltage, etc., with varying wind are described.—*L'Industrie Elec.,* Nov. 25.

Wires, Wiring and Conduits.

Aluminum for Electrical Purposes.—While during the past two years the price of copper in London has fluctuated between £112 and £54 sterling per ton, aluminum has rapidly dropped in price recently until now it is quoted in London at the same price per ton as copper. As, however, for equal conductivity only half the weight of aluminum is required as with copper, a net saving of 50 per cent on the cost of the raw material is effected by employing aluminum. The initial cost is not the only factor contributing to greater economy, since in addition there is a further considerable saving in freight and in handling, owing to the less weight of aluminum as compared with copper. For equal conductivity the tensile strength of aluminum is only three-quarters that of copper; but aluminum weighs about one-half, and no difficulties are experienced in this direction, at any rate for the larger sized wires. Greater tensile strength, at the expense of a certain amount of conductivity, may be obtained by alloying the aluminum with copper. A comparison of the physical properties of aluminum and copper wires is given in the following table:

	Copper wire.	Aluminum wire.
Specific gravity	8.93	2.65
Conductivity	100	61
Section for equal conductivity	1	1.64
Diameter for equal conductivity	1	1.28
Weight for equal conductivity	1	0.495
Tensile strength for equal section	1	0.46
Tensile strength for equal conductivity	1	0.75

As regards cables the larger diameter of the insulation, of course, makes the aluminum cable more expensive, but it is thought that it would be practicable to employ aluminum cables for high-tension transmission in crowded areas where overhead wires are not permissible.—Lond. *Electrician,* Nov. 27.

Electrophysics and Magnetism.

Law of Induction.—F. Emde.—A continuation of the theoretical paper in which the author discusses some fundamental points with respect to the law of induction. Having discussed previously the phenomena of the motion of a conductor through a constant field, he now discusses conductors at rest in a variable field. He claims that there is no use in speaking of the motion of lines of flux due to the closing or breaking of a circuit; of course, one could calculate an imaginary speed of the lines of flux from the law of induction, but in this case evidently the law of induction would not teach anything. The author then discusses the general case of motions of conductors in a variable field. He thinks that for motions of conductors in a stationary field the conception of cutting lines of force and the loop conception of magnetic flux are entirely equivalent. In general, the cutting conception is contained as a part in the loop conception. The paper is to be continued.—*Elek. und Masch.* (Vienna), Nov. 22.

Permeability at High Frequency.—L. Sehames.—The author describes a method by which, with the aid of voltage measurements in the Paulsen high-frequency circuit, two self-inductances are compared in order to determine the permeability of thin iron wires at high frequency. This method is also suitable for the comparison of capacities with each other, and for the comparison of self-inductances with capacities. The permeability values found in this way are effective mean values for a whole period. With increasing frequency the effective mean value of the permeability tends to become independent of the field strength. For the iron investigated by the author, the effective mean value of the permeability decreases very quickly with increasing frequency up to 10,000 periods per second and after that it decreases only slowly, the relation being now represented by straight lines. The author has obtained effective inductances much higher than known hitherto with magnetization with direct current. The results of the author may be explained generally by the hypothesis that in a magnetic field alternating with very high frequency the permeability has not sufficient time to assume the value which it finally assumes with direct-current or with slow-change alternating-current magnetization.—*Ann. der Phys.,* No. 11.

Magnetism.—R. Gans.—While hysteresis is an irreversible phenomenon of magnetism, the author endeavors to detect reversible magnetic phenomena and in the present paper gives a theory of "reversible longitudinal permeability."—*Ann. der Phys.,* No. 11.

Electrochemistry and Batteries.

Light Storage Battery.—R. Goldschmidt.—Some notes on a storage battery containing electrodes of zinc and nickel oxide in potassium or sodium carbonate. A 43 per cent potassium carbonate solution or a 25 per cent sodium carbonate solution may be used. The best electrodes are obtained by electrolytic

deposition of zinc and nickel on a nickel-plated iron-wire screen. The original e.m.f. is somewhat below 2 volts. Over 60 amp-hours may be obtained per kilogram of positive electrode with a discharge of 15 to 20 amp, so that the power is about 100 watts at an average e.m.f. of 1.57 volts. The weight of the positive plates is about one-third the weight of the total cell. Without hurting the plates it is possible to use a charging current of 50 amp and a discharging current of from 45 to 50 amp per kilogram of positive plates. The capacity of the nickel plates does not decrease very essentially with rapid discharges. A plate of 33 grams when discharged with 0.2 amp gave 52 amp-hours; with 0.5 amp it gave 59 amp-hours, and with 0.65 amp it gave 54 amp-hours. During the discharge the e.m.f. drops during the first hour from 2 to 1.6 volts, during the next two hours to 1.5 volts, and in the next half hour to 1.4 volts.—*Centralblat f. Accum.*, Nov. 5

Cyanamide.—A. R. FRANK.—A paper giving some details on the utilization of atmospheric hydrogen in the production of calcium cyanamide for calcium carbide and discussing some applications of cyanamide, especially as a fertilizer.—*Trans. Faraday Society*, October (Vol. 4, Part 2).

Ozone.—F. M. PERKIN.—A paper describing the methods of Siemens & Halske and of Otto for producing ozone by means of the silent discharge, and on various industrial uses of ozone, particularly for the purification of water.—*Trans. Faraday Society*, October (Vol. 4, Part 2).

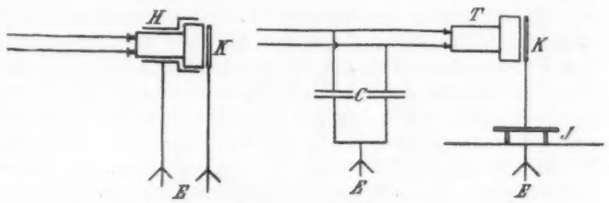
Units, Measurements and Instruments.

Lux.—L. WEBER.—An article in which the author first refers to the ambiguity in the definition of meter-candle according to what candle is meant. In numerous articles of H. Cohn, in which the limits of 10 to 50 meter-candles are quite important, hefner candles are meant. The photometrical congress in Geneva adopted the unit lux which should be equal to the illumination produced at a distance of 1 m by the international unit of candle-power, but no unit for the latter was definitely adopted. The present author thinks that as long as the hefner candle has not been adopted as the international unit of candle-power it would be wrong to define the lux as the meter-candle (hefner). The author also considers that it is necessary to establish by international agreement a secondary unit for the brightness of a surface. The unit recommended by him is the brightness of that absolutely white dull surface of which the illumination is unity.—*Elek. Zeit.*, Nov. 26.

International Electrotechnical Commission.—An account of the recent conference in London, with special reference to the work of the French committee.—*L'Industrie Elec.*, Nov. 25.

Telegraphy, Telephony and Signals.

Condenser Effects of the Telephone.—W. PEUKERT.—In cases in which a telephone line is charged electrostatically, the telephone acts as a condenser. The copper winding is equivalent to one charged plate of the condenser, the body of the person facing the telephone is equivalent to the other plate of the condenser, while the insulation frame of the telephone represents its dielectric. This fact can be shown by connecting for an instant a telephone transmission line with one pole of a 200-volt storage battery, the other pole of which is earthed. The charging condenser current which flows through a person standing before the telephone may then be directly measured. To prevent this charging current from passing through persons speaking in a telephone the following arrangements can be employed: In Fig. 3 the telephone is surrounded by a metallic cover *H* which is earthed. *K* represents the person before the



FIGS. 3 AND 4.—CONDENSER EFFECTS OF THE TELEPHONE.

telephone. To make this arrangement effective, the capacity of the condenser *H* must be larger than the capacity of the body *K*, but, on the other hand, it must be negligible in comparison with the natural capacity of the telephone line, in order not to spoil the transmission of speech. Another arrangement is shown in Fig. 4, where a special condenser *C* is connected in parallel with the telephone *T*. To make this arrangement still more effective the person *K* speaking through the telephone is insulated from earth by means of *J*.—*Elek. Zeit.*, Nov. 26.

Wireless Telegraphy.—H. POINCARÉ.—The first of his lectures held before the École Supérieure des Postes et Telegraphes, in Paris, on the theory of wireless telegraphy. The intention is not to give a complete theory of wireless telegraphy, but to explain certain mathematical theories which may facilitate the understanding of the phenomena. The author begins with Maxwell's equations and states that he will make general use of the vector potential of Lorentz. For the high frequency of the oscillations he assumes, as a first approximation, that nothing happens in the interior of the conductors, and that the electric lines of force leave the conductor in a direction perpendicular to the surface. He then undertakes the solution of the equations and shows the complications of his problem. He studies the damping effect—that is, he endeavors to determine the conditions on which the wave length and the damping of a given exciter depend. He finally discusses the action of the antennas of various forms.—*La Lumière Elec.*, Nov. 28.

Telephones for Electric Railway Service.—F. F. FOWLE.—The author considers the relative advantages and disadvantages of portable and stationary telephone sets. While the stationary type has distinct advantages, the most comprehensive telephone service for traction can be obtained by the combined use of stationary and portable types of sets. The author then describes the standard devices used to protect a telephone line from lightning and from stray currents, and finally gives some comparative figures of cost of telephone installations for electric railways.—*Elec. Railway Jour.*, Dec. 5.

NEW APPARATUS AND APPLIANCES

Banquet of Electrical Trades Association of Chicago.

The thirteenth annual meeting and dinner of the Electrical Trades Association of Chicago was held Dec. 11 at the banquet hall of the Chicago Athletic Association. About 100 representative men connected with Chicago electrical trades were present, especially those dealing with the credit end of the business. The officers for the ensuing year, which were elected during the evening, were as follows: President, William A. Browne, of the M. B. Austin Company; vice-president, F. N. Pierce, of the Manhattan Electrical Supply Company; secretary and treasurer, Frederick P. Vose, Marquette Building. The new members of the executive committee were Mr. Harry R. Parsons, of the Western Electric Company, and Mr. Frank Horton, of Moran & Hastings Manufacturing Company. Mr. Thomas I. Stacey, of the Electric Appliance Company, acted as toastmaster.

Mr. B. E. Sunny, president of the Chicago Telephone Com-

pany, talked on the general situation. He drew the conclusion that if precedents of the past few years are worth anything, the two years following the presidential election should be very prosperous ones, the presidential election year being usually dull. He also outlined some difficulties in connection with credits in the telephone business now that telephone service is being extended to a cheaper class of subscribers than formerly. Mr. A. O. Kuehnsted responded to the toast, "It Pays," outlining the many benefits to be derived from co-operation of the kind existing in the Electrical Trades Association.

Mr. Albert H. Elliott, of Oakland, secretary of the Electrical Trades Association of the Pacific Coast, made a very eloquent and witty address, dealing mainly with the importance of co-operation along certain lines, even among competitors in the electrical business. Mr. F. N. Pierce talked on "Sales and Credits." Mr. James J. Barbour, ex-state's attorney, gave some reminiscences concerning legal battles of the Electrical Trades Association.

A New Type of Self-Starter for Alternating-Current Induction Motors.

The J. L. Schureman Company, of Chicago, has recently placed upon the market a new line of alternating-current self-starters, a distinctive feature of which is the use of solenoids to perform the various functions of the starter, thus corresponding closely to direct-current practice. The Fig. 1 shown herewith illustrates the simplest type, that designed for small motors capable of being thrown directly across the line to start. It consists of a solenoid-operated switch for making and breaking the motor circuit, together with a small relay for reducing the amount of current in the control circuit to a minimum. All parts are mounted on a single slate panel with front connections and legs for bolting to a vertical surface, making a neat, compact outfit, easy to install and mount.

The main switches are closed through a crank action which requires very little power to operate and permits the use of a solenoid of moderate size. No toggle joints are used. The circuits are made and broken on heavy carbon and copper "butt-end" contacts which can be cheaply and easily replaced and are very easy of adjustment. The contact surfaces are vertical to prevent the accumulation of dust. With this style of contact all chance of "freezing" is eliminated. The operating solenoids are of a noiseless type and carry current continuously while the starter is in running position. This provides the no-voltage release feature and in case of a failure of voltage from any cause, the starter returns to the "off" position, disconnecting the motor from the line. The current consumed by the solenoids when closed is a small fraction of an ampere.

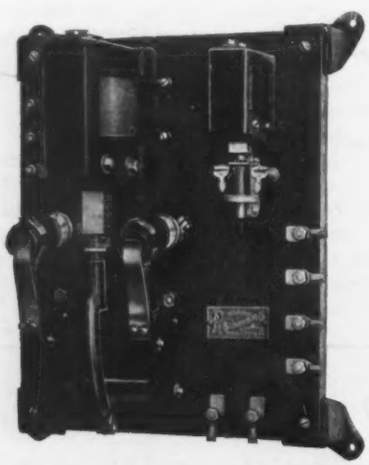


FIG. 1.—INDUCTION MOTOR SELF-STARTER.

The usual method of control, as indicated in Fig. 2, is by a remote push button or by means of a pressure or vacuum regulator. Three small wires are run to the point of control. To start, momentary contact between wires 1 and 2 closes the circuit of the relay, which in turn actuates the main line switch, connecting the motor to the line. Momentary contact between wires 1 and 3 short-circuits the relay coil and the circuit to the main switch coil is broken. The opening of this switch then disconnects the motor from the line. The relay when closed completes the circuit of its coil, hence current is carried by the control circuit only at the moments of starting and stopping.

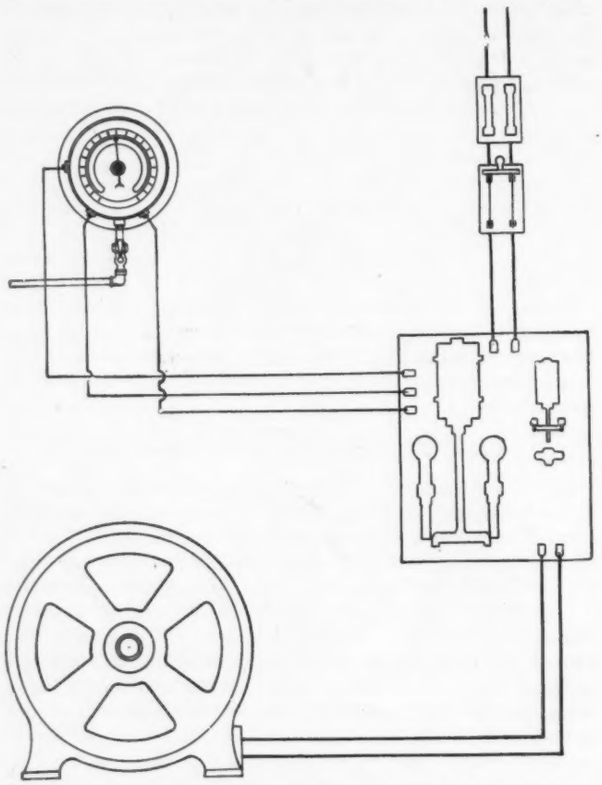


FIG. 2.—DIAGRAM OF CONNECTIONS OF SELF-STARTER.

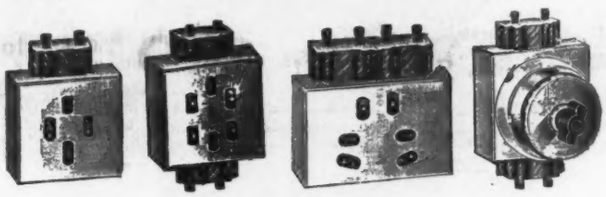
As both the starting and stopping operations are performed by making contact, no current is broken in the control circuit, eliminating arcing on the control switches.

This type of starter finds its widest use in connection with vacuum cleaning plants using remote push-button or vacuum regulator control, and in connection with small air compressors or fluid pressure pumps. On pump and compressor installations it is used with the pressure regulator control, starting and stopping the motor on the desired limits of pressure. The special points of the device are the construction of the solenoids, insuring noiseless and efficient operation; the contact-making switches, which are rugged and easy of adjustment and replacement; the compact construction and ease of mounting, and the no-voltage release feature.

Switch Block for Snap Switches.

The National Electrical Code requires that sub-bases of non-combustible, non-absorptive insulating material must be installed under all snap switches used in exposed knob and cleat work, and also in molding work, although sub-bases of hardwood may be used in the latter case if desired. With the old type of base applied to molding work it is necessary to cut and fit the molding, adding labor and expense and not always giving a satisfactory finish to the work. Frederick A. Armstrong, 348 Court Street, Brooklyn, has brought out a standard switch block of glazed porcelain which is especially adapted for molding work. The block will be made in seven different designs, three of which are at present on the market. These are intended for single-pole snap switches, single- or double-pole

snap switches, and for double-pole snap switches. The base is made to straddle the molding and is held in place by the screws necessary to fasten the switch. The arrangement is such that these screws cannot come in contact with the wires, but pass through the ridge separating the wires in the molding. The base for a single-pole snap switch is shown in Fig. 1, that for

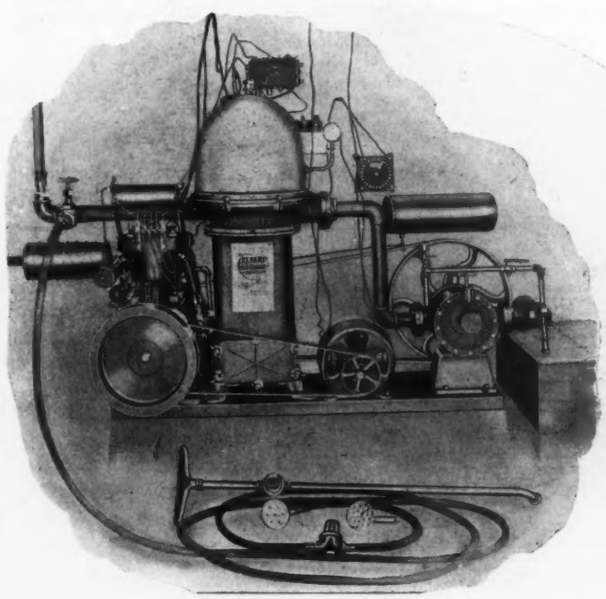


FIGS. 1, 2, 3 AND 4.—SWITCH BLOCK FOR SNAP SWITCHES.

double-pole or single-pole switch is shown in Fig. 2, and the block for double-pole switch only is illustrated in Fig. 3. Fig. 4 shows a snap switch mounted on the base which is applicable for single-pole or double-pole switches. The switch blocks are listed among the approved fittings.

Residential Lighting Outfit.

There are many farms, country estates and dwellings in isolated sections where electricity would gladly be used were it easily obtainable, and in order that the many advantages of electric service may be had where central-station distribution lines are lacking, it is necessary to install an isolated plant which will not require constant or expert attention. The Trebert Gas Engine Company, of Rochester, N. Y., has brought out a rather compact residential lighting outfit, which also combines a vacuum-cleaning outfit and operates in conjunction with a storage battery. The combination shown in the accompanying illustration comprises a two-cylinder, four-stroke cycle gas engine rated at 10 hp; a 55-volt generator, large enough to supply energy to 40 8-cp lamps; a vacuum pump; 27 cells of battery with sand trays having storage capacity for eight 8-cp lamps for five hours; a dust collector; switchboard; water tank and an as-

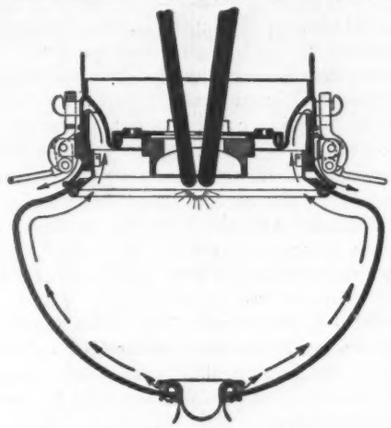


RESIDENTIAL LIGHTING OUTFIT.

sortment of vacuum-cleaning attachments. The generator is belted to the gas engine, as is also the vacuum pump, and all are mounted on a common bedplate. The engine is equipped with flywheels so as to reduce fluctuating voltage owing to irregularity of speed to a minimum, and in order that the noise of the engine exhaust shall not be objectionable, a muffler forms part of the exhaust connection.

Ventilating Ash Tray for Flaming Arc Lamps.

As users of flaming arc lamps well know, the products of combustion from the electrodes accumulate on the bottom and sides of the lamp globe, and owing to the heat, become so fastened to the glass that they are with difficulty removed. The deposit also absorbs much of the light, so that the amount available from the lamp is greatly reduced. It has been found that by ventilating the globe in a certain way the products of com-

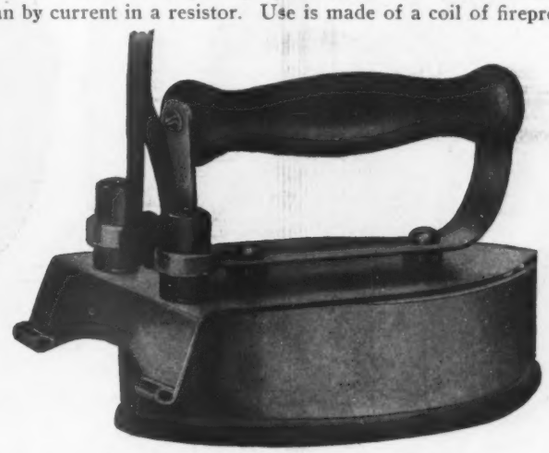


ASH TRAY FOR FLAMING ARC LAMP.

bustion pass off and are not deposited in the globe. In the Polar flaming arc lamps marketed by Fox Brothers & Company, of New York City, the ash tray is designed as shown in the accompanying illustration. The cold air from the outside passes through the openings provided and is constrained to pass around and sweep the inner surface of the globe instead of passing directly up through the center. This simple expedient is said to keep the interior of the globe free from deposits and thus to insure as much light from the lamp at the time it is switched out of circuit as when the lamp is first started.

Alternating-Current Smoothing-Iron.

The smoothing-iron shown in the accompanying illustration differs from other devices designed for the same purpose in that the heat is developed by hysteresis in an iron core rather than by current in a resistor. Use is made of a coil of fireproof



ALTERNATING-CURRENT SMOOTHING-IRON.

wire surrounding a portion of the magnetic circuit. Since the coil is relatively cool compared to the working surface, it is claimed that the danger of "burning out" has been eliminated. Moreover, the heat being produced just where needed, the loss of heat is minimized and the economy is high. Thus, a 6-lb. iron consumes less than 450 watts under working conditions. The iron is pointed at the back as well as at the front for the

proper handling of fancy articles. When not in use the iron may be tipped back on the end of the handle and resting plate, or an iron stand with asbestos pad can be employed. The terminals are equipped with a flexible cord so connected that it will neither kink nor be subjected to abrasion.

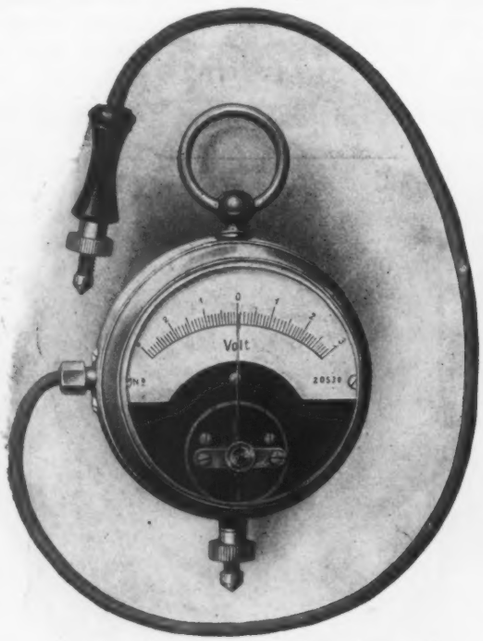
The hysteresis type of alternating-current smoothing-iron has been placed on the market by the W. N. Durant Company, Milwaukee, Wis.

Pocket Voltmeters and Ammeters.

James G. Biddle, of Philadelphia, is introducing on the American market a line of direct-current pocket voltmeters and ammeters, made in Germany, and here marketed under the trade name "Ja-ga-bi" instruments. These instruments are constructed on the "moving coil" system and possess the advantages peculiar to that type of construction. No claim is made that these instruments will replace the standard portable meters manufactured here, but on the other hand it is asked that they be not confused with the many cheap pocket instruments with which the market is flooded. Of necessity the accuracy of indications is restricted because of the short scale, but the instruments themselves are adjusted with extreme care and the workmanship is first class. The series includes self-contained voltmeters up to 150 volts and self-contained ammeters up to 10 amp. An instrument of special value is a voltmeter with a range from 0.2 to 2.8 volts, intended for testing single cells of storage battery.

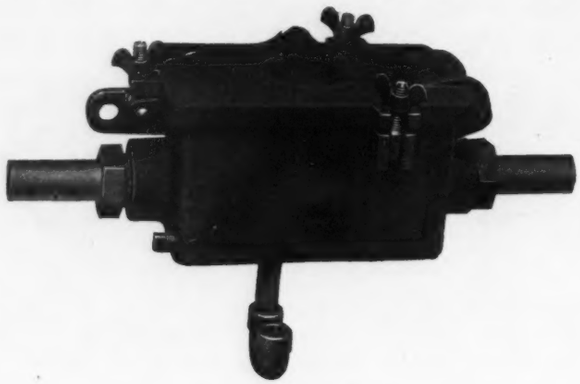
Oil-Immersed Fuse.

The oil-immersed fuse shown in the accompanying illustration has been designed for use on a 4100-volt system. The fuse box is small and can be placed either on a pole or in a manhole. The fuse proper is a bare copper wire; when it "blows" the arc is extinguished by the oil, without damaging the box.



POCKET VOLTMETER AND AMMETER.

It is claimed that the fuse may be replaced by an employee in perfect safety, all parts with which he would come in contact being "dead" when the box is open. The box can also be used as an oil switch for disconnecting branch circuits when it is necessary to work upon them. It is recommended, however, that the fuse be removed and the box closed at this time to prevent the possibility of moisture getting into the oil. The box is so designed as to allow of the escape of gases formed by the disintegration of the fuse when blown, thus relieving the box from all strain. The vent pipe is so arranged as to allow of an oil seal, thus preventing any absorption of moisture by the oil in the box and maintaining the dielectric strength of the oil.



OIL-IMMERSED FUSE.

The oil-immersed fuse boxes have been placed on the market by the Ricker Manufacturing Company, Rochester, N. Y. They are built for e.m.fs. not exceeding 11,000 volts.

Variable Standard of Self-Induction.

In the variable standard of self-induction illustrated herewith the coils are embedded in two hard-rubber disks which turn on each other. These coils are D-shaped and are the same in the upper and the lower disks. They are so placed in these disks that each one takes up approximately half of the disk in which it is located and is on one side of the diameter. By rotating one of the disks through a half circle, the relative position of the coils is changed from that in which they lie exactly over each other to that in which they are entirely separated. It will be seen that this arrangement makes the portion of the area of the disks which coincides vary uniformly with the rotation and consequently insures a uniform scale. This result shows one of the decided advantages of the arrangement.

VARIABLE STANDARD OF SELF-INDUCTION.

The coils are compound wound. For the higher range of inductance (9 to 105 millihenrys) the two sections of the compound winding are used in series, all of the four coils being also connected in series. For the lower range (0.7 to 12 millihenrys) the greater part of the winding of each coil is cut

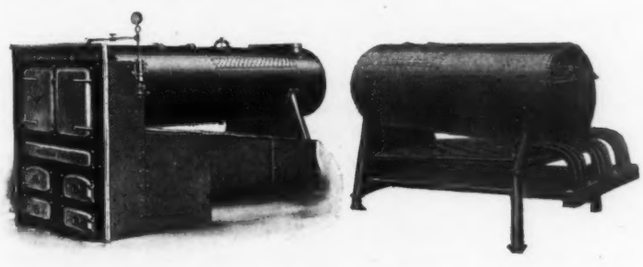
out, a compensating non-inductive resistor being provided so that the change from the high to the low range can be made without disturbing the bridge balance. However, a special terminal is provided so that connection can be made directly with the low-range coils, where a high time-constant is of advantage. The connections are clearly shown on each instrument.

The above-described instrument has been patented by Mr. F. G. Mainbridge. The Leeds & Northrup Company, of Philadelphia, has acquired the rights for its manufacture and sale in this country.

Combination Fire and Water-Tube Boiler.

A boiler combining the features of the horizontal, return-tubular and the water-tube types is being built by the Traylor Engineering Company, of Allentown, Pa. The boiler is known as the "Hawkes" and a skeleton view and a view showing it, steel-jacketed, are given in Figs. 1 and 2 herewith. In the lower part are two rows of water-tubes, the upper row connecting into a front water-saddle at the forward end of the tubular section and with the water-leg at the rear. The tubes in the lower row connect into the rear water-leg and also into a series of steel box-headers at the front end, which are in turn connected to the front head and saddle by means of independent circulating tubes. The upper row of tubes is covered with split firebrick which forms a roof over the furnace and prevents the hot gases from coming in contact with the shell of the tubular member.

The tubular section is made of steel, the tubes being expanded and beaded into the heads and liberal manholes and handholes being provided for inspection and cleaning purposes. The front water-saddle and rear water-leg are made without riveted joints, except where they are attached to the shell of the tubular boiler. The legs are provided with stay-bolts and the front saddle is provided with compression plugs placed opposite each tube, thus eliminating the need of gaskets. The front box-headers for the lower water-tubes are made of steel, the bearings for the hand-hole plates being faced on the inside to insure good contact for the gaskets. Each header is independently connected to the tubular boiler and the water circulation is as follows: The colder water passes down the rear water-leg into the water-tubes which are inclined upward toward the front end of the boiler. The water passes upward and forward through these tubes in the same direction as the travel of the gases into the front water-saddle headers and circulating tubes into the front end of the tubular boiler and through this to the rear. Scale is said to be deposited on the bottom of the shell of the upper tubular member, away from fire action, and the water-tubes in the lower section are said to be kept free from scale owing to rapid circulation.



FIGS. 1 AND 2.—COMBINATION FIRE AND WATER-TUBE BOILER.

The boiler is supported independent of the brick setting by cast-iron columns beneath the corners of the front water-saddle and rear water-leg. The brickwork, therefore, need not be so heavy as ordinarily is required. The side walls extend to the top row of the water-tubes and the rear wall to the bottom of the rear water-leg, the front expansion chamber between the boiler front and front head of the tubular section being cased in steel and lined with firebrick. The rear supporting column is provided with expansion plates; rollers support the rear water-leg and the front water-saddle rests on the front columns, expansion being taken care of to the rear of the setting and away from the masonry walls. The lower water-tubes expand to the front, the box-headers being mounted on expansion plates.

A Dutch-oven type of furnace is provided, the arch being self-contained and consisting of a series of interlocking tile carried on the lower row of water-tubes and extending well back of the bridge wall. The arch dips downward over the grates toward the rear, the products of combustion coming in direct contact with the heated arch as well as the furnace brickwork and the bridge wall. The gases travel over the latter into an adequate combustion chamber to the rear of the bridge wall, before reaching the passage formed between the top of the arch over the grate and the covering of the upper tubes, passing thence to the front end of the tubular section where the gases are distributed through the tubes of the tubular member. The boiler is adaptable to the condition of low head room and limited length and width. The gases travel practically three times the length of the shell.

Chandelier for Nernst Lamps.

The new Westinghouse Nernst system is responsible for the development of a line of chandeliers that gives a greater volume of light for a small light source than it is possible to get with any of the old incandescent lighting chandeliers. These chandeliers now being put on the market are made in highly artistic designs in Renaissance and Art Nouveau. They are made in solid castings or in a combination of castings and spinnings, and finished as standard in statuary bronze and satin brass.

The novel feature about these chandeliers is the arrangement of the mechanism of the lamps in the central ornamental ball, which conceals it completely and at the same time makes it easily accessible. This leaves nothing at the ends of the arms

CHANDELIER FOR NERNST LAMPS.

except the small screw base burners, and these occupy less space than any other incandescent lamps of equal candle-power. The 132-watt burner, for instance, giving light equivalent to that of seven 16-cp carbon-filament lamps, occupies a space at the end of the arm of only 3 in. x 4½ in. This makes it possible to get a large volume of light without using a multiplicity of sources, or infringing the law of proportions by making the sources too large for the other parts of the chandelier.

Motor-Driven Coal Conveyor.

A motor-driven coal conveyor has been installed on the twin-screw steamer *Minnesota*, a 28,000-ton vessel in service between Seattle and the Orient. The conveyor has as its principal feature a removable block of malleable iron inserted between the chain links, as shown in Fig. 1, and so shaped that the chain

FIG. 1.—SECTION OF CHAIN SHOWING REMOVABLE BLOCK.

may adapt itself to any turn in a vertical or horizontal plane, as illustrated in Fig. 2. This feature makes it possible to run the conveyor around a rectangular path in a steel trough under the main deck of the steamship, and serve bunkers having a total capacity of 3400 tons on both sides of the boat.

A longitudinal bulkhead running the entire length of the ves-

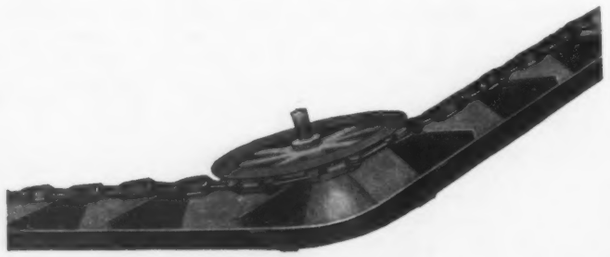
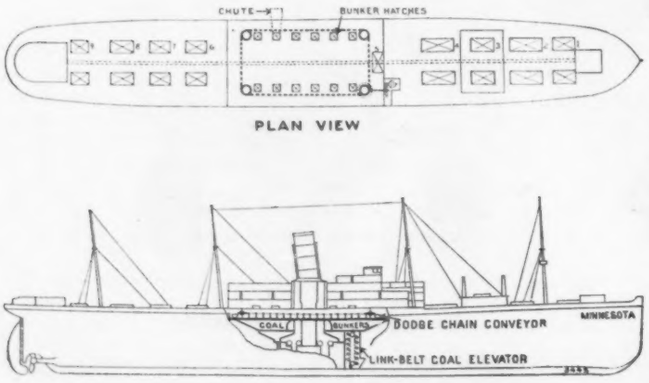


FIG. 2.—CHAIN TURNING AN ANGLE.

sel, and making of it practically two ships, emphasizes the utility of the conveyor, as there is no need of changing the vessel's position, or that of the coal barge, to procure duplicate broadside loading; delivery can be made to every part of the bunkers without interruption, or the starboard side may be



FIGS. 3 AND 4.—DIAGRAM OF INSTALLATION ON SHIPBOARD.

supplied by the conveyor and the port side fed direct through the hatch—both operations being simultaneous.

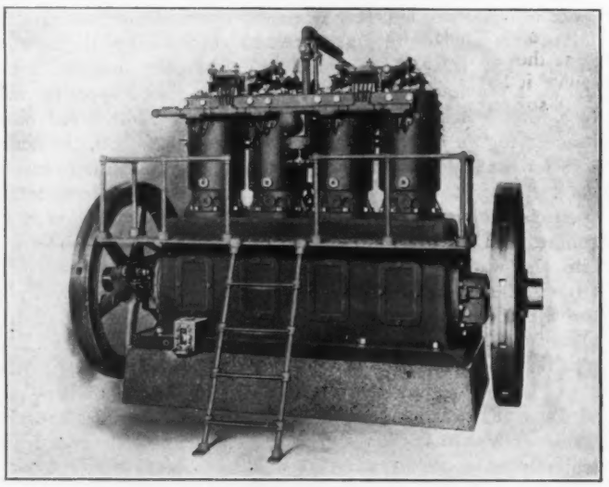
Figs. 3 and 4 show a side view of the machine over the bunkers and a plan of its rectangular travel. The normal capacity of the machine is 90 tons per hour at a speed of 125 ft. per minute, bituminous coal of a size that will pass through a 5-in. mesh screen being fed to it through hatch chutes.

This first delivery is made by means of tub hoists, averaging 1000 lb. of coal at a lift, at best a somewhat slow and tedious process, but the only feasible method because of the awkward barges from which the supply is taken. Notwithstanding these crude facilities, it is claimed that the machine has justified the expense connected with its installation by paying for itself in two voyages.

The conveyor, which was built by the Link-Belt Company, Philadelphia, is driven by a 20-hp General Electric motor; the two elevators are driven by a similar motor rated at 10 hp.

Vertical Multi-Cylinder Gas Engine.

The Bruce-Meriam-Abbott Company, of Cleveland, Ohio, has brought out a rational development of its standard type, two-cylinder engine in the shape of a vertical four-cylinder engine which is built especially for the close regulation needed in electrical work. The engine, which is shown herewith, embodies all the features of the standard engines of the company with some improvements. The ignition system is the most notable of the latter. While still adhering to the high-tension, jump-spark system of ignition, which has proved so satisfactory with this type of engine on producer and natural gas, the cylinders have been arranged so that there are two spark plugs to each. A duplicate system of coils, timing commutators and wiring forms part of the equipment, so that the two plugs are fired simultaneously, thereby reducing the possibility of shut-down due to the fouling of the plugs. The plugs are, moreover, in



GAS ENGINE.

serted on a horizontal position in the path of the incoming gases so that the tendency is for the gases to keep them clean. The timing commutator and all the parts are immersed in oil. Provision is made for cutting one commutator out of action for inspection without otherwise interfering with the operation of the engine.

The exhaust valves are of the water-cooled type, the water entering and passing out through small brass pipes running down the interior of the hollow steel stem. All the valves are provided with separate cages, thus facilitating inspection and repair. The mixer is practically of standard pattern. The shaft is of forged steel, and the two inner cranks are opposed to the two outer cranks. As the timing of the cylinders is arranged so as to obtain one impulse on one crank at each half revolution, an even turning movement is obtained. The shaft runs in babbitt metal bearings, all of which have wedges for adjustment with points for calibration to facilitate the lining up of the shaft at any time. The engines are rated to take an overload of 10 per cent.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The approach of the end of the year and the general closing up of accounts has always the effect of limiting trade in jobbing circles. Not only is this year no exception in this respect, but there seems to be an additional trend toward conservatism caused by the experiences of the last 12 months. In industrial lines quite an amount of machinery is still idle, but there are many orders being booked for delivery in 1909, and there are vast numbers of inquiries which show that business is surely coming back to a normal basis. In the building industry there is some activity. The month of November saw an immense activity with heavy gains over the same month last year, when the depression was at its worst. The aggregate expenditure in 88 cities of the United States was $58,710,266, which was a decrease of 6.2 per cent from October, but was a gain of 80.5 per cent from November of a year ago. Taken as a whole, however, the 11 months of 1908 are 14 per cent smaller than the same period in 1907. One of the most encouraging signs of the times is the gradual increase in railroad earnings. In the iron and steel industries there has not been much betterment. Pig iron is comparatively dull except in the Birmingham district, where a number of good sales have been made. Prices are firm and the feature of the situation is the number of urgent demands for small lots on immediate delivery. There are a number of inquiries for structural material, but actual orders are not active. In steel rails there is every indication that the early business of 1909 will be heavy. In addition to the report that the Pennsylvania Railroad will order 160,000 tons, which while it has not been confirmed has been allowed to go undenied so long that it is now accepted as fact, there are many other orders in sight. For instance the Rock Island is expected to buy 50,000 tons and the New York, New Haven & Hartford at least 25,000 tons. One of the trade features of the week which affected prices was the report made by the Government that the cotton crop would be 12,920,000 bales. Accepting these figures to be correct, there is no difficulty in understanding the low price of the staple. The only question as far as practical business is concerned, is whether the Southern planters will market their crops. If they hold, and are in a financial position to hold, trade will be dull in the southern States for some time to come. If the planters let go at prevailing prices, there will be plenty of money in the South. Failures for the week ended Dec. 10, as reported by *Bradstreet's*, were 298, as against 234 in the week previous and 284 in the corresponding week of 1907; 220 in 1906; 226 in 1905, and 239 in 1904.

THE COPPER MARKET.

Final returns for November on the production of copper indicate that it was slightly less than for the month of October. The output of the mines in this country is figured at 89,000,000 lb., and the imports amounted to 22,000,000 lb. In October the total production and import were about 128,000,000 lb. The complete returns of exports during the month of November indicate that the shipments were 43,335,000 lb. The domestic consumption during the same time was about 43,000,000 lb. This would indicate an accumulation during the month of about 24,000,000 lb. It is, of course, difficult to give copper figures with accuracy. One of the most careful statisticians of the financial market not connected directly with the copper selling industry figures that at least 75,000,000 lb. have been produced since the first of the year over and above all of the takings for consumption and export. The Government report indicated that on Jan. 1 the surplus stock carried was 135,000,000 lb. Using these figures as a basis there would appear to be 210,000,000 lb. of copper in this country ready for market. It must be admitted, however, that such a condition is directly opposed to all the statements that are given out by the producers and by the selling agencies. About the middle of November it was announced by these people that they had no available copper with which to fill orders for immediate delivery. It is hard to understand what could have become of such an enormous surplus of copper, as seems apparent from statistics, and it is equally hard to understand where such an amount of copper, if it really existed in this country, could be so completely hidden from public view. The fact that the market is controlled by strong financial interests is practically an assurance that there will be no heavy break in quotations. In spite of the fractional concessions in price during the week there has been no pressure to sell. The market has drifted along with little buying and little selling. Consumers are waiting for further orders for manufactured products before accumulating heavy stocks, and sellers are willing to wait for a demand before forcing metal upon the market. Exports for the month including Dec. 14 were 10,122 tons. Quotations on the metal exchange on this date were:

Lake	14¼ @ 14½
Electrolytic	14 @ 14¼
Castings	13⅞ @ 14⅛

London quotations are as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	63	15	0	62	12	6
Standard copper, futures	63	15	0	63	12	6
Market	Easy.			Easy.		
Sales of spot	800 tons					
Sales of futures	1,200 tons					

Extreme fluctuations for this year:

	Highest.			Lowest.		
Lake copper, spot	14½			12⅜		
Electrolytic copper, spot	14⅜			12¼		
Casting copper, spot	14¼			12⅛		
London, spot	£64	17	6	£56	5	0
London, futures	65	15	0	56	17	6
London, best selected	68	10	0	60	0	0

MANUFACTURERS ASK FOR DUTY ON PLATINUM WARES.—J. Bishop & Company, Malvern, Pa., manufacturers of platinum utensils for chemical purposes, have written a petition to the Ways and Means Committee of Congress, seeking a duty of 25 per cent ad valorem on manufactures of platinum, which are now admitted free under the Dingley Law. There is a duty of 45 per cent on platinum articles imported, not intended for chemical purposes. The claim for protection is supported by the statement: "Owing to the cheaper labor cost, European manufacturers are enabled to sell platinum for chemical purposes, such as vases, retorts, crucibles, dishes, wire, foil, etc., at a lower price than they can be made for in this country. We ask that as manufacturers of such apparatus we be given a certain amount of protection, the same as other manufacturers of chemical and scientific apparatus, thereby giving a larger field of employment for skilled American labor, and enable us to pay higher wages than can now be done."

ALUMINUM TARIFF A MATTER OF CONTROVERSY.—The fact that the Aluminum Company of America produces practically all the aluminum that is made in America, owing to the ownership of the two principal patents covering its manufacture, has created quite an interest in the discussion of the tariff on the metal. In spite of the fact that the disruption of the European combination has destroyed the agreement on prices abroad, and resulted there in a drop to 13 cents per pound or less, the high tariff, it is claimed, has prevented any benefit to the manufacturers here who use the metal, who maintain that prices here are at least 100 per cent too high. A duty of 8 cents per pound enables the sellers of raw material in this country to get 22 to 24 cents per pound for metal that is selling abroad for 15 cents. This condition has caused a vigorous fight to be made by the independent handlers against the trust. Just at the present time these interests are making their fight by attempting to secure a modification of the tariff, the campaign being engineered by the New Jersey Aluminum Company, which is probably the largest concern outside of the trust in this country. H. M. Willis, the manager of this company, has recently sent out a circular to every consumer of aluminum urging him to use every influence to secure a tariff reduction. In this circular, Mr. Willis says: "It is

an established fact that the Aluminum Company of America is slowly creeping into the manufacture of finished aluminum wares, thereby weakening the position of many who are dependent on it for raw materials. It is scarcely necessary to explain how impossible it is to compete with it in certain lines in view of the fact that it can furnish itself with metal at cost. Therefore, it becomes the duty of every purchaser of aluminum to demand a reduction of the present tariff, which will enable every individual or concern to procure aluminum from abroad if necessity requires it. Unless something is done in this direction we will in a short space of time have to face a still greater monopoly than already exists, the proof of which lies in the fact that because eventually it will have eliminated all competition in finished products, thus controlling the entire market. The investments of the various concerns in the United States who manufacture from aluminum and are dependent upon the trust amount to millions of dollars, and what we need is an open market for aluminum in its raw state, to be free to buy in foreign markets without making it compulsory to deal with a monopoly, which stands alone without competition and whose profits are excessive owing to the protection which they receive on account of the high rate of duty."

CHICAGO ISOLATED ELECTRIC POWER PLANTS.—Ground will be broken in May, 1909, in Chicago for the erection of a reinforced-concrete building for the Western Newspaper Union, which will be equipped with an electric generating station, to provide current for lighting the building, running presses, operating elevators, etc. The specifications for the power plant apparatus will be completed early next year. The building is being designed by Mr. S. N. Crawen and is to be erected by Adelaine F. Sharp, both of Chicago. The Chicago Packing Company is soon to begin the erection of a new packing house at the Chicago Stock Yards which will contain an electric generating station to supply current for lighting the building and furnishing power for the motors to be installed in the packing house. The plans and specifications for the power plant are now being prepared under the direction of Mr. Z. T. Davis, architect, 79 Dearborn Street, Chicago, Ill. The Miller & Hart Packing Company, Chicago, Ill., will soon ask for bids on engines, generators, motors and accessory power plant supplies for installation in a new packing house, which will be completed early in 1909. The plant will be operated throughout by electric motors from power generated in the company's own plant. The proposals for electrical equipment, which will be asked for shortly, will require definite answers as to when the equipment can be delivered. The power-house equipment will include two horizontal non-condensing engines which are to be direct connected to two 250-kw revolving-field generators, with a guaranteed maximum capacity on non-inductive load of 312 kw at 230 volts. The motors and their respective horse-power will be as follows: One 40 hp, one 35 hp, three 20 hp, two 15 hp, three 10 hp, six 5 hp, and one 3 hp. The architect having charge of the construction of the packing house plant is Z. T. Davis, 79 Dearborn Street, Chicago. Mr. George H. Rowe, of George H. Rowe & Company, 115 Adams Street, Chicago, has charge of the electrical and mechanical details of the construction.

ALLIS-CHALMERS COMPANY.—A large order recently booked by the Allis-Chalmers company is the installation of an electrical drive throughout the big Washburn-Crosby flour mill of Minneapolis, Minn. This mill is one of the largest in the world and has a total output of 6000 barrels of flour per day. The new plant is expected to develop 3000 hp and the generator installation will be steam turbine units. Individual motors will be used to drive the various rollers and other apparatus throughout the mill. The installation will be similar to that in the big Hecker-Jones mill, which was also supplied by the Allis-Chalmers Company. Reports from this company indicate that business has been gradually improving during the fall, and in November was 80 per cent better than in the same month last year. There have been specially liberal orders for mining machinery and also considerable business in turbine engines for high-pressure fire-fighting systems. One of the large installations recently put in is for a tie-preserving plant for the Pennsylvania Railroad.

WESTINGHOUSE SHOPS GETTING BUSY.—With the beginning of December the business at the various factories of the Westinghouse companies has taken a decidedly brighter aspect. The renewed activity in the railroad world has brought a number of excellent orders to the Westinghouse Air Brake Company, as well as to the Union Switch & Signal Company, the latter being particularly fortunate in securing the contract from the Rock Island system for the equipment of 1250 miles of track with the electro-pneumatic system. At the electric works the discharge of the receivers appears to have given a fresh impetus to the entire establishment. There is an improvement reported from all the different departments. The railway branch is now in the midst of preparations for turning out the apparatus called for by the $5,000,000 contract awarded some time ago by the Pennsylvania Railroad for the electrification of the New York terminals; and this work, which has been increased by several other contracts, gives the railway shops again the appearance of the scenes of activity so familiar in 1906 and 1907. But the other departments are also reaping the benefit of a returning business activity. The power department, for example, has orders and prospective business for motors, particularly those smaller sizes used for operating manufacturing plants, and also motors applied to domestic uses, which have never been so large as at present.

THE WAGNER ELECTRIC MANUFACTURING COMPANY has made an interesting water-pumping installation at the Wabash railroad shops at Moberly, Mo. At this point a reservoir has been constructed in which a supply of water is stored for use in the dry season. The cost of transporting fuel to the reservoir made a steam plant impractical and an electrically-driven pump was installed with power derived from the shops. The power is stepped up from 440 volts alternating current, through Wagner transformers, to 2200 volts and transmitted 2½ miles to the pumping station, where it is reduced to 440 volts. The pumping station equipment consists of a Dean triplex single-acting pump, 350 gal. per minute capacity, which is driven by a Wagner Electric Company's 25-hp, three-phase, slip-ring motor, controlled by a Cutler-Hammer self-starter and a pressure regulator. In operation the pump has to work against a head equivalent to 85 lb. pressure. The tank into which it discharges is two miles away from the pumping station. The only attention required is from a man who goes there once in every two or three days and fills up the compression grease cups. The outfit has been in service for nine months and is found very reliable.

PLANT FOR THE PACIFIC MILLS.—Through the office of Charles T. Main, of Boston, designing engineer, the Pacific Mills, of Lawrence, Mass., have recently placed orders for additional power house equipment as follows with the Allis-Chalmers Company for a steam turbine with turbo jet condenser and generator of 3250-kw capacity and additional exciter and switchboard apparatus, and with the Bigelow Company for 12 additional horizontal return tubular boilers, of practically the same size as those contained in the first installation. These boilers will be supplied with superheaters. The buildings are of sufficient size to contain all of this new apparatus, which completes the unit of station planned for and built. Another chimney will be built of the same size as the one recently erected, namely, 200 ft. high and 9 ft. diameter inside the core.

RECENT TRIUMPH ORDERS.—The Triumph Electric Company, of Cincinnati, O., reports the following recent contracts: Greenpoint Metallic Bed Co., Greenpoint, L. I., one 200-kw generator and 20 motors, ranging in sizes from 10 to 30 hp and aggregating 400 hp; Rapid Motor Vehicle Co., Pontiac, Mich., one 100 kw engine type generator; Lake Erie Provision Co., Cleveland, O., one 50-kw engine type generator and one 75-kw engine type generator; Lamb Fish Lumber Co., Charleston, Miss., one 125-kw engine type generator; Rehbun Last Co., Cincinnati, O., one 100-kw engine type generator; Robt. Mitchell Furniture Co., Cincinnati, O., one 75-kw engine type generator.

HUSUM (WASH.) CONTRACTS.—The Husum (Wash.) Power Company has let a contract for its hydraulic equipment to the Portland Iron Works for a pair of Samson turbines and a Woodward governor, and to the General Electric Company through S. E. Gates, Portland, Ore., for electrical equipment.

THE BABCOCK & WILCOX COMPANY has purchased from the Rust Boiler Company its patents and plant located at Midland, Pa., and will continue the manufacture, at that point, of the Rust water-tube boiler.

THE BOCA ANCHA MINING COMPANY, of Ayutta, Jalisco, Mexico, is about to install an electric power plant of 200-hp, which will be transmitted a distance of about a mile.

Financial Intelligence.

THE WEEK IN WALL STREET.

There has been no distinctive tendency to the stock market during the past week. While the general tone has been strong enough to prevent any serious reactions, there has been abundant evidence that the public was not participating in the trading. Some speculative dealing has occurred, but it has been mostly indulged in by regular traders. Following the policy which has marked their course for several months, the insiders who have been behind the upward movement were inactive, selling not at all and buying only when there seemed to be a tendency in prices to retrograde. One feature of the market that was something of a novelty was the partiality shown for the cheaper grade of railroad securities. While the old time favorites were still the market leaders there was a great increase in dealing in such stocks as Wabash, Chesapeake & Ohio, Erie, Toledo, St. Louis & Western and a number of other issues that are still a long way below par. It was the general impression that this trading came largely from professionals and not from bona-fide investors. There is an impression current that the leading issues of the market have been pushed about as high as it is safe to expect them to go and that the market advances in the near future will be in the cheaper stocks which have been heretofore neglected. There has never been any particular reason why Reading, Southern Pacific and Steel common should continue to bound upward while equally substantial issues dragged at low prices. That this has been the case is clearly indicative of the professional character of the upward movement. Vast quantities of certain favorite issues have been traded in day after day. Quotations on these have been advanced far beyond their intrinsic value when the general condition of business is considered, and it is only natural that there should be some hesitation about going further. There were during the past week several distinctly encouraging features. The placing of the preferred shares of Wisconsin Central upon a 4 per cent basis indicated that there is a feeling of encouragement in regard to railroad earnings in the Northwest and the increase in the dividend of the Western Union shows that business in that line is returning to normal conditions. The earnings of the company for the last quarter of 1908 are estimated at $2,000,000, which is almost double the earnings for the same quarter in 1907. It is taken that the recovery from the long and expensive strike has been very satisfactory. Another point that is of encouragement to the Street is the apparent harmony that exists among the principal banking interests. This was indicated by the joint purchase of Panama bonds and in the raising of $10,000,000 to help the Brazilian Government finance its coffee colorization scheme. The publication of the total returns from the crops show that the producers will receive more money in the aggregate for their year's work than ever before. The condition is one that should certainly mean prosperity for the agricultural districts and such prosperity means a general buying ability which will be felt in all industrial and commercial circles. The bond market continues very strong and investment houses are kept busy hunting securities for their eager customers. Not only have high grade securities been in exceptional demand, a condition that has existed for many months, but some issues that are more or less speculative have been brought to the front and find a ready sale. It may be that this is due to the manipulation of traders, or it may be that there is a vast quantity of money in the country that will seek investment wherever it looks like a bargain could be found. The money market continues easy in spite of the persevering demand from France. The continued disposition on the part of the Parisian bankers to accumulate gold has resulted in additional engagements for export. Up to Dec. 14 there had been $5,400,000 taken for shipment to Paris, but this has not had any visible effect upon the money market. On the date mentioned call money was quoted at 2½ to 3 per cent, and 90-day paper at 3¼ per cent. The figures in the table are those of the close December 14.

NEW YORK.

	Dec. 7.	Dec. 14.	Shares sold.		Dec. 7.	Dec. 14.	Shares sold.
All.-Ch.	15⅛	16⅛	15,070	Int.-Met., pfd.	36	39⅝	78,700
All.-Ch., pfd.	48⅛	51¾	23,800	Mackay Cos.	75⅛	74¾	1,624
Amal. Cop.	83⅛	82	103,255	Mackay Cos., pfd.	70¾*	69½	600
Am. D. T.	35*	35*	——	Manhattan Elev.	149⅝	149¾	8,400
Am. Loc.	55¼	55½	18,445	Met. St. Ry.	30*	31*	1,110
Am. Loc., pfd.	109½	110*	225	N.Y. & N.J.Tel.	112*	112*	——
Am. Tel. & Cbl.	78*	78*	——	Steel, com.	54¼	54½	385,215
Am. T. & T.	128½	128¾	7,020	Steel, pfd.	112½	112½	11,547
B. R. T.	55⅜	57⅜	108,770	W. U. T.	69¾	68⅜	13,000
Gen. Elec.	157	158	4,000	West'h., com.	90⅝	88½	3,850
Int.-Met., com.	14¾	16⅞	98,260	West'h., pfd.	115	120*	161

PHILADELPHIA.

	Dec. 7.	Dec. 14.	Shares sold.		Dec. 7.	Dec. 14.	Shares sold.
Am. Rys.	46*	46*	——	Phila. Elec.	11	11¼	——
Elec. Co. of A.	10¾	11¼	——	Phila. R. T.	21¾*	22¼	——
Elec. Stor. B'ty.	42	44½	——	Phila. Traction.	90	90½	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	50	49⅞	——

CHICAGO.

	Dec. 7.	Dec. 14.	Shares sold.		Dec. 7.	Dec. 14.	Shares sold.
Chi. City Ry.	180*	180*	——	Chi. Tel. Co.	129	129	——
Chi. Rys., Ser. 1.	118*	118*	——	Met. El., com.	16*	17	——
Chi. Rys., Ser. 2.	44*	44*	——	Nat'nal Carbon.	86*	86*	——
Com. Edison.	106	106½	——	Nat. Carb., pfd.	112*	112*	——
Chi. Subway.	25	27	——				

BOSTON.

	Dec. 7.	Dec. 14.	Shares sold.		Dec. 7.	Dec. 14.	Shares sold.
Am. Tel. & Tel.	128⅝	129	——	Mass. E. R., pfd.	58¾	57¼	——
Cum. Tel.	127¾	127¾	——	Mex. Tel.	2	2¼	——
Gen. Elec.	159½*	158	——	Mex. Tel., pfd.	5½	5½*	——
Edison El. Ill.	251*	251	——	N. E. Tel'p.	125	127	——
Mass. Elec. Ry.	12	12	——	W. Tel. & Tel.	7¾	7¾*	——
				W. T. & T., pfd.	78½*	78½*	——

*Last price quoted.
Shares sold are for week Dec. 7 to Dec. 12.

DIVIDENDS.

United Gas Improvement Company, Philadelphia, Pa., quarterly, 2 per cent, payable Jan. 15.

American Car & Foundry Company, preferred, quarterly, 1¾ per cent, payable Jan. 1.

American Car & Foundry, St. Louis, Mo., common, quarterly, ½ per cent, payable Jan. 1.

Canadian Westinghouse Company, Ltd., Hamilton, Ont., quarterly, 1½ per cent, payable Jan. 11.

Western Union Telegraph Company, New York, quarterly, ¾ per cent, payable Jan. 15.

Otis Elevator, New York, preferred, quarterly, 1½ per cent, payable Jan. 15.

El Paso (Tex.) Electric, preferred, semi-annual, 3 per cent, payable Jan. 11.

Canadian General Electric, Toronto, Ont., common, quarterly, 1¾ per cent, payable Jan. 1.

Duluth (Minn.) Edison Electric Company, preferred, quarterly, 1½ per cent, payable Jan. 1.

Columbus (Ga.) Electric Company, preferred, semi-annual, 3 per cent, payable Jan. 1.

Columbus Gas & Fuel Company, Columbus, Ohio, preferred, quarterly, 1¼ per cent, payable Jan. 1.

Halifax (N. S.) Electric Tramway, Ltd., quarterly, 1½ per cent, payable Jan. 2.

Bangor Railway & Electric Company, Bangor, Me., quarterly, 1¼ per cent, payable Jan. 1.

Central District & Printing Telegraph Company, Pittsburg, quarterly, 2 per cent, payable Jan. 20.

THE WESTINGHOUSE REORGANIZATION.

The following statement of assets and liabilities of the Westinghouse Electric & Manufacturing Company, dated Sept. 30, 1908, was submitted to the court by the receivers in their application to Judge James S. Young in the United States District Court, Pittsburg, with reference to their discharge:

ASSETS.

Property and plant	$20,961,908
Stocks and bonds of other companies	31,188,310
Raw materials, finished stocks, etc	9,874,373
Cash	9,059,990
Subscriptions to new stock	6,000,000
Special cash deposit	1,535,120
Accounts receivable	5,488,827
Notes receivable	1,227,082
Deferred assets	2,963,084
Total	$88,318,694

LIABILITIES.

Capital stock	$40,370,150
Convertible 5 per cent sinking and gold bonds	22,134,877
Debenture certificates due July 1	1,196,000
Collateral 6s, 3-year notes, due Aug. 1, 1910	6,000,000
Collateral 5s, 10-year notes, due Oct. 1, 1917	2,702,703
Collateral 4, 5, 6 and 15-year 5 per cent notes	1,474,650
Current accounts, interest, taxes, etc	2,452,602
Subscription securities of affiliated companies	756,945
Reserve, inventory adjustments, etc	178,473
Surplus	10,279,292
Total	$88,318,694

Judge Cross, of the United States Circuit Court at Newark, N. J., on Dec. 9, signed an order discharging the auxiliary receivership established for the Westinghouse Electric & Manufacturing Company in New Jersey.

WESTERN UNION TELEGRAPH COMPANY.—The directors of the Western Union Telegraph Company (New York) met on Dec. 9 and declared a quarterly dividend of ¾ of 1 per cent, an increase of ¼ of 1 per cent, as compared with the two previous quarters. This action by the directors places the stock on an annual dividend basis of 3 per cent. R. C. Clowry, president of the company, said after the meeting: "Notwithstanding the setback caused by last year's strike and the long depression which followed, we feel encouraged with reference to our business. We paid ½ of 1 per cent dividend for the quarters ended June 30 and Sept. 30, or at the rate of 2 per cent per annum. For the present quarter, ending Dec. 31, our estimated net earnings over and above all fixed charges are 1½ per cent, or at the rate of 6 per cent per annum, and it was deemed best to increase the dividend to ¾ of 1 per cent, or at the rate of 3 per cent per annum. The company's property is in excellent condition at present, and it is thought best to husband our resources so as to continue to maintain it in good condition and be prepared for any increase of traffic." The company has issued its statement for the quarter ended Sept. 30, 1908. It compares as follows with the same period of 1907:

	1908	1907
Net revenue	$1,864,955	*$311,493
Bond interest	433,062	433,062
Balance	$1,431,893	*744,555
Dividends	497,820	1,217,025
Surplus	$934,073	*$1,961,580
Previous surplus	14,393,856	16,884,781
Total surplus	$15,327,929	$14,923,201

*Deficit.

WASHINGTON WATER POWER COMPANY.—The stockholders of the Washington Water Power Company, Spokane, Wash., have authorized the directors to issue $15,000,000 in bonds and have accepted the proposal of Lee, Higginson & Company, Boston and New York, and Moffat & White, New York, to take the entire issue. Of the issue, $6,000,000 bonds will be placed on the market in 1909, when $1,000,000 in new stock will also be issued. The company plans to expend $7,000,000 in the betterment and extension of its railway, power and light systems in and near Spokane. The betterments will include a plant now under construction at Little Falls on the Spokane River, the extension of the underground wires in Spokane with a view to the ultimate removal of poles from the streets and the erection of a power plant and substation at Post Street and the Spokane River. Part of the latter building will be used for a passenger station until an adequate passenger station can be built.

STANISLAUS ELECTRIC POWER COMPANY.—Mr. Patrick Calhoun, president of the United Railroads of San Francisco, has confirmed the purchase by the United Railways Investment Company of the property of the Stanislaus Electric Power Company. The power company has outstanding $9,000,000 of common stock and $3,000,000 of preferred stock, and also an issue of $6,000,000 in bonds, a total of $18,000,000. The United Railways Investment Company, which is the holding corporation for the United Railroads of San Francisco and the Philadelphia Company, Pittsburg, is at present capitalized at $34,000,000, of which $15,000,000 is preferred and $19,000,000 common stock. The capacity of the plant of the Stanislaus Electric Power Company will be 64,000 hp, of which 24,000 hp will be purchased by the United Railroads of San Francisco for operating its lines, and 40,000 hp sold for light and power purposes.

HUDSON RIVER ELECTRIC POWER COMPANY.—The committee of the bondholders of the Hudson River Electric Power Company, of which James R. Hooper is chairman, has been increased by the addition of Wilson A. Shaw, president of the National Bank, Pittsburg, and Charles E. Willock, treasurer of the Fidelity Title & Trust Company, Pittsburg. The same committee is now acting for the bonds of the Hudson River Electric Power Company, Hudson River Water Power Company, Hudson River Electric Company, Empire State Power Company, Hudson River Power Transmission Company, Saratoga Gas, Electric Light & Power Company, Madison County Gas & Electric Company and the Ballston Spa Light & Power Company.

ROCKLAND LIGHT & POWER COMPANY.—Perry, Coffin & Burr, Boston, and N. W. Harris & Company, New York, are offering for subscription $500,000 of 5 per cent first mortgage bonds of the Rockland Light & Power Company, Nyack, N. Y., dated Nov. 2, 1908, and maturing 1938. This issue is secured by a first mortgage on the principal part of the property of the company, which controls practically the entire light and power business of Rockland County, New York, and of the northeastern section of New Jersey. The total bonded debt of the company is $550,000, requiring an annual charge of $27,500. The net earnings of the company for the year ended Sept. 30, 1908, were $59,310, or more than twice the interest requirements.

NEW ORLEANS RAILWAY & LIGHT COMPANY.—The Canal-Louisiana Bank, the Whitney-Central Band, and the Hibernia Bank, New Orleans, have exercised their option on $2,441,000 general mortgage 4½ per cent bonds of the New Orleans Railway & Light Company, New Orleans, La., dated 1907, which were pledged in 1908 to secure an issue of $1,300,000 6 per cent notes due June 20, 1909, but subject to call on any interest day at 101. The sale has enabled the company to pay practically all of its outstanding debts incurred for improvements and additions. The amount of general mortgage bonds outstanding is increased by the sale to $17,484,000.

VIRGINIA PASSENGER & POWER COMPANY.—Judge Waddill in the United States Circuit Court at Richmond, on Dec. 7, entered orders granting the Metropolitan Trust Company, New York, trustee of the Virginia Passenger & Power Company's debenture bonds, the Bowling Green Trust Company, New York, trustee under the consolidated mortgage, the Central Trust Company, New York, trustee under under the mortgage of the Richmond Passenger & Power Company, Richmond, Va., and certain other creditors, permission to appeal from the judgment of foreclosure sale ordered by him on Oct. 24, 1908.

QUINCY GAS, ELECTRIC & HEATING COMPANY.—H. W. Noble & Company, New York, Philadelphia and Detroit, and Poe & Davies, Baltimore, are offering at 93 and interest, at which price the yield is 5½ per cent, the unsold portion of $900,000 first consolidated mortgage 5 per cent gold bonds of the Quincy Gas, Electric & Heating Company, Quincy, Ill., dated Sept. 1, 1905, and due Sept. 1, 1935, but redeemable, all or any part, at 105 and interest on Sept. 1, 1910, or any interest date thereafter. The interest is payable March 1 and Sept. 1 at the Union Trust Company, Detroit, trustee.

BOSTON EDISON ILLUMINATING COMPANY.—The stockholders of the Edison Electric Illuminating Company, Boston, will vote on Dec. 18, 1908, on the question of increasing the capital stock of the company from $12,643,600 to $13,616,100 by the issuance of 9725 shares, authorized by the Massachusetts Gas & Electric Light Commission on Feb. 20, 1907. Holders of each 13 shares of record Dec. 18 will be entitled to subscribe on or before Jan. 15 for one new share (par $100) at 215 per cent, paying therefore installments $100 on Feb. 1 and $115 on May 3, 1909.

PHILADELPHIA, COATESVILLE & LANCASTER RAILWAY.—The property of the Philadelphia, Coatesville & Lancaster Passenger Railway, Parkesburg, Pa., is advertised to be sold under the terms of the mortgage (without foreclosure proceedings) at Lancaster on Dec. 30, the interest due on the $600,000 mortgage for which the Integrity Title Insurance, Trust & Safe Deposit Company, Philadelphia, is trustee, being in default. The road is partly built in Chester County, and considerable grading has been done in Lancaster County.

ROCHESTER RAILWAY & LIGHT COMPANY.—E. R. Barnard, Philadelphia, offers for sale at 98½ and interest first consolidated mortgage 5 per cent gold bonds of the Rochester Railway & Light Company, dated July 1, 1904, and due July 1, 1954, of the denomination of $500 and $1,000. The Security Trust Company, Philadelphila, is trustee. Interest is payable Jan. 1 and July 1 at Philadelphia, New York, and Rochester. The issue is subject to call at $110 and interest.

ATLANTIC & SUBURBAN RAILWAY.—The Atlantic & Suburban Railway, Atlantic City, N. J., was incorporated in New Jersey on Dec. 7 with $650,000 of authorized capital stock as a reorganization of the Atlantic City & Suburban Traction Company recently foreclosed. The directors are: Robert Wetherill, president; William S. Blakeley and Richard Wetherill, Chester, Pa.; John S. Black, Atlantic City, N. J.; Garnett Pendleton, Poland, Pa.

MINNEAPOLIS GENERAL ELECTRIC COMPANY.—Blodgett, Merritt & Company, Boston, have sold all of the $1,100,000 first mortgage 5 per cent gold bonds of the Minneapolis (Minn.) General Electric Company. They were issued for subscription at 98½ and accrued interest. The bonds are secured by a first mortgage on all the property of the company, which includes the city plant and a 12,500-hp development on the St. Croix River, 40 miles from Minneapolis, with a 60-ft. right of way. In 1907, D. C. Jackson and Willian B. Jackson, Boston, appraised the property at $4,937,712, which inventory and valuation were subsequently indorsed by Professor Cooley, of the University of Michigan. The gross earnings for the year ended Oct. 31, 1908, were $983,751, and the balance, $182,291. The company has paid dividends of 6 per cent per annum on its preferred stock continuously since Aug. 1, 1899, and 4 per cent per annum on the common stock since Feb. 1, 1906.

POWER PLANT AT ZION CITY, ILL.—Contracts have been let for the construction of a power plant at Zion City, Ill., to furnish light and power for Marshall Field & Company's lace factory in that city. D. H. Burnham & Company, Jackson Boulevard, Chicago, are the architects, and W. H. Mortimer & Son, 132 Monroe Street, Chicago, Ill., have the general contract for the construction of the building. The power house equipment, most of which has already been purchased, will consist of the following: Three 250-hp Sterling boilers, Murphy furnaces, two 75-kw. Crocker-Wheeler, 220-volt, direct-current generators, two Ideal engines, and a 1000-gal. Underwriters' fire pump for sprinkling purposes. The lace factory has heretofore obtained current from the Zion City municipal light plant, but because of reverses of the Zion City affairs, Marshall Field & Company found it necessary to erect its own power station.

CAROLINA VALLEY (ELECTRIC) RAILROAD.—This partly constructed road, to extend from Thomasville to Denton, N. C., 30 miles, was sold at receivers' sale at High Point, N. C., to Mr. M. L. Jones, Denton, N. C., and Mr. W. T. Van Brunt, New York. At the same time the rights and franchises of the North Carolina Electric Company were sold to Mr. E. D. Steele, High Point, and Mr. Van Brunt. The purchasers are reported as saying that both roads will be completed. The line of the North Carolina Company was to be built from High Point to Thomasville, Greensboro and Winston-Salem. A mile of track has been laid at High Point and most of the grading done between that city and Thomasville.

SMALLER CENTRAL STATIONS AND THE TUNGSTEN LAMP.—Manufacturers of tungsten lamps are daily becoming more and more optimistic over the outlook for the general adoption of the metallic-filament lamps by the smaller central stations throughout the United States. They report that there is a growing tendency among the smaller central station companies to take the initiative in the matter of placing tungsten lamps at the disposal of their customers and face at once the problem of reduced current consumption, rather than to await their introduction by a dealer and thereby incur the ill-will of the skeptical public with which they have to deal. This tendency is said to be especially strong in the Middle West and the West, where the small companies have been slow in introducing this type of lamp.

A CLEVELAND TELEPHONE SITUATION.—It is reported that important changes may be made in the management of the Cuyahoga and United States Telephone Companies at an early date, including a successor to James S. Brailey, Jr., who had been at the head of both companies for some years. Action in regard to adopting the holding company plan some time ago is said to enter into the case, but that the Brailey interests opposed the action at the last moment and the plan was turned down.

CITIZENS' GAS & ELECTRIC COMPANY, WATERLOO AND CEDAR FALLS, IA.—Charles S. Kidder & Company, Chicago, and Breed & Harrison, Chicago, are offering at 97½ and interest the unsold portion of a block of $250,000 5 per cent sinking fund gold bonds dated Jan. 1, 1906. These bonds are part of an authorized issue of $1,200,000, of which $923,500 are outstanding, $120,000 are reserved to retire an equal amount of Waterloo Gas & Electric Company 5s and $156,500 are reserved for additions, extensions, etc.

LEHIGH VALLEY TRANSIT COMPANY.—Assents having been received from the holders of a large majority of the outstanding preferred and common stock of the Lehigh Valley Transit Company, Allentown, Pa., the voting trust has been extended as to the assenting certificates for a further period of three years from Nov. 3, 1908, the trustees having power to terminate the trust earlier.

ASHEVILLE RAPID TRANSIT COMPANY.—The property of the Asheville (N. C.) Rapid Transit Company, including Overlook Park, was sold at auction on Dec. 8 at Asheville for $25,000, the upset price, to R. S. Howland, representing the bondholders of the company.

THE COLUMBUS (O.) EDISON COMPANY will hold its annual meeting at the Ohio National Bank on the evening of Jan. 12. The regularly quarterly dividend of 1½ per cent on the preferred stock will be paid on Jan. 2.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus
Chicago (Ill.) Telephone Company:					
Ten months ended October 31, 1908	$7,211,039	$3,276,878	$3,934,161	$2,027,533‡	$1,906,628
Ten months ended October 31, 1907	7,229,287	3,322,471	3,906,816	2,191,688‡	1,715,128
Fairmount & Clarksburg Traction Company, Fairmount, W. Va.:					
October, 1908	37,267	12,636	24,631	1,927	22,704
October, 1907	34,504	15,119	19,385	1,797	17,588
Ft. Wayne (Ind.) & Wabash Valley Traction Company:					
October, 1908	113,391	59,931	53,459	.....	.....
October, 1907	114,883	63,872	51,011	.....	.....
Hudson Valley Railway, Glens Falls, N. Y.:					
Quarter ended September 30, 1908	196,474	135,558	60,916	56,661	4,255
Quarter ended September 30, 1907	238,001	145,359	92,642	53,969	38,673
Lexington (Ky.) & Interurban Railways:					
October, 1908	53,731	36,804	16,927	.....	.....
October, 1907	52,538	31,459	21,079	.....	.....
New England Telephone & Telegraph Company, Boston, Mass.:					
Year ended June 30, 1908	10,684,830	8,426,975	2,221,855	1,601,868†	319,986
Year ended June 30, 1907	9,746,199	7,764,629	1,981,570	1,784,689†	196,881
Norfolk (Va.) & Portsmouth Traction Company:					
October, 1908	156,796	88,317	68,479	.....	.....
October, 1907	*257,515	158,954	98,561	.....	.....
Schenectady (N. Y.) Railway:					
Quarter ended September 30, 1908	255,340	159,517	95,823	32,153	63,670
Quarter ended September 30, 1907	322,783	244,310	78,472	34,903	43,569
Utica (N. Y.) & Mohawk Valley Railway:					
Quarter ended September 30, 1908	313,411	181,548	131,863	82,227	49,636
Quarter ended September 30, 1907	328,918	218,722	110,196	81,442	28,754

*Year of Jamestown Exposition.
† Dividends.
‡ Maintenance and reconstruction.

GENERAL NEWS

Construction News.

MONTGOMERY, ALA.—The capital stock of the People's Electric & Ice Company has been increased from $50,000 to $200,000, the proceeds to be used to enlarge the plant.

HELENA, ARK.—Application has been made to the City Council by J. W. Burks for a franchise to construct and operate an electric street railway in Helena.

LITTLE ROCK, ARK.—The Penitentiary Board of the State of Arkansas is now considering the question of abolishing the electric light plant now in operation at the penitentiary. It is stated that a local electric company will furnish the service for much less than it now costs to operate the plant. It is reported that Commissioners W. C. Braley and Guy B. Tucker are considering the question of installing an electric light plant in the State Hospital for Nervous Diseases.

NASHVILLE, ARK.—A proposition has been submitted by J. C. Stephenson to the City Council for the installation of an electric light plant.

VAN BUREN, ARK.—At a mass meeting held recently the citizens adopted resolutions calling on the City Council to secure a continuous and efficient electric and gas service from the Fort Smith Light & Traction Company, and in case the Council cannot make satisfactory arrangements with the company to take such action as may be necessary to cancel franchise, in order that the city may negotiate with other parties for the service.

GLENDALE, CAL.—Plans are being considered for establishing a street lighting system in Glendale. L. C. Brand, a large property owner in Glendale, has offered to furnish electricity for lamps if the city will build the distributing system and lease it to him for a term of years at a nominal rental, the city to be given an option to purchase the plant at the expiration of the lease. A committee has been appointed to confer with Mr. Brand and to secure a definite proposition from him.

HEALDSBURG, CAL.—The Board of City Trustees has awarded the contract for additional equipment to the municipal electric light plant, as follows: For water wheel to the Pelton Water Company, of San Francisco, Cal., for $2,143, and for dynamo to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., for $2,422.

INDEPENDENCE, CAL.—Bids will be received by the Board of Supervisors until Jan. 5 for a franchise giving the privilege of constructing and operating a telephone system in the towns of Independence, Lone Pine, Keeler, Darwin, Dallarat, Skidoo and intervening towns. W. L. Hunter is clerk.

MODESTO, CAL.—Arrangements have been completed for the construction of an electric railway from Modesto to connect with the Santa Fe Railroad at Empire, five miles distant. It is reported that the railway will be extended to Oakdale, connecting with the Sierra Railway to Sonora.

OAKLAND, CAL.—The Home Telephone Company has petitioned the Supervisors for a franchise to extend its system into the country districts.

PLACERVILLE, CAL.—George L. Threlkel has filed notice of appropriation of 10,000 cu. in. of water of the Middle Fork of the American River to be utilized for power and mining purposes.

REDONDO, CAL.—Arrangements are being made by the Pacific Light & Power Company to duplicate its $1,500,000 power plant at Redondo.

SACRAMENTO, CAL.—The Board of City Trustees is considering the question of placing all the electric wires underground in the business section of the city.

SACRAMENTO, CAL.—Negotiations are under way for the merger of the Yolo County Consolidated Water Company and the Clear Lake Railway Company. The railway company, it is said, contemplates extending its railway from Napa to Yolo. The water company secures its water from Cache Creek, and the railway company wants to develop the water power of the creek and proposes to build a dam to store the water.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company, it is reported, contemplates the construction of two new power houses.

SAN FRANCISCO, CAL.—The controlling interest of the Stanislaus Electric Power Company has been purchased by the United Railroads Investment Company, the holding company for the San Francisco and Pittsburg Street Railway companies. It is stated that the Harriman roads will secure electricity from the Stanislaus plant for operating its system over Sierra.

SAN FRANCISCO, CAL.—The State Harbor Commissioners have instructed Engineer Barker and Chief Electrician Whorff to prepare plans and estimates of the cost of an underground conduit system of sufficient capacity to accommodate all wires of the electric lighting, power, telephone and telegraph companies in San Francisco. The proposed system is to extend on East Street from Folsom Street to Vallejo Street.

VALLEJO, CAL.—Randall, Trowbridge & Company, of Oakland, Cal., have applied to the Board of City Trustees for a franchise covering the principal streets of the city for the purpose of constructing an electric railway.

CRESTED BUTTE, COL.—The Crested Butte Light & Water Company has completed the installation of its water power plant and will rewire the town next spring. W. H. Whalen is manager.

RIFLE, COL.—A franchise has been granted to C. L. Todd and associates to construct and operate an electric light plant in Rifle. A company is being organized to operate the plant.

STONINGTON, CONN.—The citizens are considering the question of establishing a municipal electric light plant. The electrician engaged by the Warden and Burgesses to investigate the electric lighting proposition in his report states that an electric plant could be equipped for about $20,000. It is estimated that with a municipal electric plant electricity could be generated at a cost of 10 cents per kw-hour; the price now paid the Mystic Power Company is 16 cents per kw-hour.

ST. AUGUSTINE, FLA.—The contract for lighting the streets of the city has been awarded to the St. Johns Light & Power Company for a term of one year. The company is to furnish 233 60-cp incandescent tungsten lamps at the rate of $19.25 per lamp per year and 29 arc lamps at $7 per lamp per month. The rate for furnishing electricity for lighting the city building and fire station is $20.50 per month. The cost of this service will be about $7,000 per year. The contract goes into effect Jan. 1, 1909.

WHITE SPRINGS, FLA.—We are informed that bids for the construction of the large power plant on the Suwanee River, near White Oaks, Fla., by the Suwanee River Railroad & Power Company will be received about Feb. 10, 1909. The cost of the work is estimated at about $3,000,000. D. G. Zeigler & Company, of Jacksonville, Fla., will have charge of the work.

ASHBURN, GA.—It is reported that an election will soon be held to vote on the proposition to issue bonds for a municipal electric light plant.

ATLANTA, GA.—The Board of Commissioners of Fulton County has granted a franchise to C. Elmer Smith, of the S. Morgan Smith Company, of York, Pa., to erect high-tension transmission lines on the streets circling the city of Atlanta, for purpose of furnishing manufacturing concerns with electricity. Mr. Smith has secured the property of the North Georgia Electric Company from the receivers, which includes the electric plant at Gainesville on the Chattahooche River, 50 miles distant. The company proposes to furnish electricity from the Gainesville plant to the suburbs of Atlanta. It is said that the new owner will immediately claim its franchise rights and lay conduits throughout the city of Atlanta. C. Elmer Smith and associates have purchased several water-power sites in Georgia and also has other developed and undeveloped sites along the Chattahoochee River, together with sites near Cartersville, Griffin and Americus, where it is proposed to erect dams.

AUGUSTA, GA.—The Twin City Power Company has petitioned the City Council for a 50-year franchise to erect a distributing station in Augusta for the distribution of electricity for lamps, heat, motors and other purposes.

BLUE RIDGE, GA.—The municipal electric light plant is nearly completed and is expected to be put in operation about the middle of January. The plant is located 5½ miles west of the town and will be operated by water power. It will also furnish electricity to light the towns of McCays and Duston, Tenn. The plant will have an output of 50 kw to start with, and plans are being made to duplicate the present equipment. An appropriation of $18,000 was made to construct the plant. H. H. Baughan is chief engineer.

EAST POINT, GA.—E. H. Davis, of Griffin, Ga., has been appointed to take charge of the engineering work of the municipal electric light plant and water works system, bids for the construction of which will be opened about Jan. 19. The citizens recently voted to appropriate $85,000 for the construction of an electric light plant, water works and sewerage systems.

MACON, GA.—The question of constructing an electric light plant at Vineville is under consideration. For further information, address the Mayor.

MACON, GA.—The Central Georgia Power Company, which is erecting a large plant on the Ocmulgee River, near Jackson, Ga., is now closing contracts with manufacturers and citizens in Macon, Ga., for the use of electricity for lamps and motors. It is expected that the service will begin Jan. 1, 1909. The company expects to supply about 15,000 hp in Macon.

OROFINO, IDAHO.—Arrangements are being made for the installation of an electric light and power plant in Orofino. J. F. Englehorn and K. D. Ousterhaute are interested in the project.

WALLACE, IDAHO.—It is reported that the Northern Pacific Railroad Company has purchased the power plant of the Chicago, Milwaukee & St. Paul Railroad Company, located near Taft, Mont., for $150,000. It is said that the Northern Pacific Railroad Company is preparing to

tunnel the ridge near the Montana-Idaho State line. The power plant will be used in connection with the construction of the proposed tunnel, which will be about two miles long.

WARDNER, IDAHO.—The North Idaho Telephone Company is constructing a telephone line from Enaville to Murray, and is also erecting a metallic copper circuit for toll use and two iron circuits for local use. The company is also erecting a new cable from Wallace to Burke.

CARLYLE, ILL.—Plans are being considered for extensive improvements to the municipal electric light plant, which will include the erection of a new power house, the installation of new boilers and one direct-connected unit with a rating of 150 kw. The cost of the work is estimated at about $20,000. George Schilling is superintendent.

MOUND CITY, ILL.—Plans are being made by the Mound City Water, Light, Power, Heat & Manufacturing Company to install a new engine early in 1909. A. J. Dougherty is president and manager.

VILLA GROVE, ILL.—The Villa Grove Electric Company contemplates installing a dynamo and engine in its plant. C. W. Hegerman is president and manager.

LA PORTE, IND.—Arrangements are being made by the La Porte Public Utility Company to rebuild its electric plant, which was recently destroyed by fire. Otto Wettstein is secretary and manager.

MOROCCO, IND.—The Morocco electric light plant formerly owned by W. J. Harpole, has been sold to C. C. Carpenter. The new owner proposes to enlarge and remodel the plant.

SHIRLEY, IND.—The plant and buildings of the Farmers' Mutual Telephone Company, of this city and county, have been sold to H. N. Rhorer. It is said that the new owner will improve and enlarge the plant and install new equipment.

WARSAW, IND.—The Commercial Telephone Company announces that it will construct a new circuit east from the local exchange for a distance of 16 miles.

COON RAPIDS, IA.—Frank McNally, of Carroll, Ia., has leased the Coon Rapids telephone system for a period of five years.

DAVENPORT, IA.—Plans are being prepared by the Brady Street Progressive Association for a special street lighting system on Brady Street between Second and Fifth Streets. The system proposed provides for tungsten lamps of 160 cp. The cost for the three blocks is estimated at $2,162. The service will be furnished by the People's Light Company. It is stated that the company is planning to erect a substation in the city for the purpose of placing all of the special street lighting service on one circuit.

DELHI, IA.—Plans are being made to construct a 20-ft. dam in the Maquoketa River to develop 1000 hp. The town of Delhi is to subscribe $8,000 and outside parties $10,000 toward the cost of the dam. G. M. Albrook is promoting the enterprise.

KINGSLEY, IA.—The Kingsley Telephone Company is planning to install a new switchboard in the local exchange.

SIOUX CITY, IA.—Extensive improvements are planned by the Sioux City Telephone Company to its local telephone system during the next year, which will involve an expenditure of about $75,000. It is proposed to install four branch exchanges and the installation of a new switchboard with automatic telephones in the Morningside exchange.

VILLISCA, IA.—A franchise has been granted to F. P. Taylor to construct and operate an electric light and power plant in Villisca. The cost of the proposed plant is estimated at from $12,000 to $15,000. The Villisca Electric Company has secured a temporary injunction enjoining the city from granting a franchise to F. P. Taylor to construct an electric light plant.

KANSAS CITY, KAN.—The Kansas City Electric Light & Power Company has applied to the City Council of Rosedale for a franchise to furnish electricity for street lighting and for residential and commercial lighting.

FRANKLIN, KY.—Contracts have been placed by the Franklin Electric & Ice Company for two 105-kw, 60-cycle, three-phase Westinghouse alternators, which will be installed within a few weeks. Orders have also been placed for a 15-ton ice plant, to be operated in connection with the electric plant. A 24-hour service will be established as soon as the new equipment has been placed. B. F. Gardner is secretary and manager.

MT. STERLING, KY.—Plans are being made by the Kentucky Telephone Company to construct and operate a telephone system, for which a 20-year franchise has been granted.

GRAND CANE, LA.—Arrangements are being made by the De Soto Telephone Company to improve and enlarge the local telephone system. J. M. and E. E. St. Clair are owners of this division of the system.

NEW ORLEANS, LA.—Plans are being made for the construction of an electric railway from New Orleans to Grand Isle Construction & Improvement Company, of which L. H. Marrere, Sr., is president. Contract for the construction of the road has been awarded to Black & Laird, of New Orleans. The railway will be 50 miles in length connecting Grand Isle, with the terminus of the Gretna electric car line in New Orleans. It will be operated under the name of the Grand Isle Seaboard Railroad Company.

CALAIS, MAINE.—Surveys are being made of the water privileges at Baring, where it is reported that a power plant will be erected by parties interested in the Calais Street Railway. Charles F. Pray, superintendent of the street railway, is making the surveys.

ELLICOTT CITY, MD.—The Patapsco Electric & Manufacturing Company is planning to erect a 11,000-volt transmission line to Westport, West Arlington and Mt. Washington, Md. William Buchsbaum is manager.

CLINTON, MASS.—The Connecticut River Power Company has applied to the Board of Selectmen for a franchise to erect its transmission lines in Clinton.

HAVERHILL, MASS.—The capital stock of the Haverhill Electric Company has been increased from $335,000 to $446,800, the proceeds to be used for additions and improvements to the plant.

METHUEN, MASS.—It is reported that the Southern New Hampshire Street Railway Company has purchased the Bevins property located at the corner of Mystic and Pelham Streets, on which it will erect a power station and car barn in the near future.

FARWELL, MICH.—The citizens on Dec. 8 voted in favor of the proposition to issue $3,000 in bonds, the proceeds to be used to establish an electric light plant.

FLINT, MICH.—The Flint Electric Company has been organized for the purpose of taking over the plant and holdings of the Flint Light & Power Company.

MENDON, MICH.—The Southern Michigan Telephone Company contemplates the installation of a complete telephone plant in Mendon.

STANDISH, MICH.—The Eastern Electric Company, of Au Sable, is acquiring the right of way, and franchises are being granted along the D. & M. Railway, also at Saginaw and Bay City. The company proposes to furnish electricity for lamps and motors. The plant will be operated by water power from the Au Sable River.

TRENTON, MICH.—The Washtenaw Light & Power Company, which recently purchased the municipal electric and water plants, is making arrangements to erect a new plant.

WYANDOTTE, MICH.—The Board of Public Works has notified the City Council that it is ready to furnish electricity for the additional lamps ordered, provided the Council will appropriate $970 for a new switchboard and pay $68 for each lamp installed.

AITKIN, MINN.—It is reported that Oscar Claussen, of St. Paul, Minn., consulting engineer, has secured control of the Aitkin Light & Power Company and will commence work on the plant in the spring.

FARIBAULT, MINN.—The Faribault Gas & Electric Company contemplates installing additional electric equipment in its plant. It is proposed to increase the output of the plant by 370 hp.

FERGUS FALLS, MINN.—Owing to the freezing of the water along the entire length of the river, the municipal electric plant was obliged to close down recently.

MAHNOMEN, MINN.—Bids will be received by A. O. Vachon, village recorder, until Jan. 6 for the construction of an electric light plant.

NORTH REDWOOD, MINN.—The Redwood Falls Electric & Power Company has applied for a franchise to furnish electricity in North Redwood. The company proposes to extend its transmission line from its plant in Redwood Falls to this village.

REDWOOD, MINN.—Plans are being considered to organize a home telephone company to install a local telephone system to cost about $11,000. Recorder Smith is interested in the project.

REDWOOD FALLS, MINN.—Plans are being considered by A. C. Burmeister, of Redwood Falls, Minn., for the construction of a hydro-electric plant, the equipment of which will include two 100-kw generators and water wheels. The cost of the plant, including the distributing system is estimated at between $20,000 and $30,000.

PASS CHRISTIAN, MISS.—The City Council has granted a franchise to the Gulfport & Mississippi Coast Traction Company to install an electric lighting system in this city, the same to be in operation by April 1, 1909. The City Council has also entered into a contract with the company whereby it is to furnish electricity for lighting the streets of the city for a term of 10 years, at a cost of not less than $1,800 per year. The company was recently granted a franchise to construct an electric railway from Pass Christian to Gulfport, which will involve an expenditure of $200,000. Work will begin on the railway as soon as the city widens Second Street, upon which the railway is to enter the city.

CHARLESTON, MO.—The Southeast Missouri Telephone Company is making arrangements for extensive improvements to its system in Dexter and Caruthersville, Mo. The company also contemplates rebuilding the exchange at Kennett, Mo.

COLUMBIA, MO.—Plans have been completed for the construction of the new independent telephone plant in Columbia.

WILLOW SPRINGS, MO.—We are informed that J. S. Brown, owner of the Willow Springs electric light plant, contemplates the construction of a complete new plant after the first of the year. The location of the plant will probably be changed.

BIG FORK, MONT.—Plans are being made by Mr. Jessup to light Mill Creek by electricity in the near future. He has purchased equipment for the plant.

BUTTE, MONT.—The Madison River Power Company is rebuilding its transmission line from its plant in the Madison River Canyon, a few miles southeast of Norris to Butte, a distance of 60 miles. The company is replacing its poles with steel towers 56 ft. in height. The cost of the transmission line is estimated at more than $300,000.

GREAT FALLS, MONT.—Notice of appropriation of water rights for two power plants between the Black Eagle Falls and the Great Falls has been filed by John G. Morony, vice-president of the Great Falls Water Power & Townsite Company. Each appropriation was for 25,000 cu. ft. of water per second. It is proposed to develop the water power to be utilized for various purposes, including generating electricity to operate power plants and street railway systems within the State of Montana.

LANCASTER, N. H.—New boilers are being installed in the plant of the Lancaster & Jefferson Electric Light Company. Plans are also being made to install a new steam engine.

NEWARK, N. J.—The South Broad Street Merchants' Improvement Association has decided to install additional lamps on South Broad Street, between Market and Court Streets, the cost to be borne by the merchants. There will be 34 arc lamps installed at a cost of $8,000. The association has agreed to enter into a three-year contract with the Public Service Corporation to furnish electricity for the lamps on a basis of $15 per month per lamp, the lamps to burn four hours a night during the summer and six in the winter.

BATH, N. Y.—The Bath Electric & Gas Light Company contemplates rebuilding and extending its transmission lines throughout the town. H. Howard Smith is superintendent.

BERGEN, N. Y.—At an election held Dec. 8 the citizens voted to establish an electric lighting system at a cost not to exceed $6,000.

CHATEAUGAY, N. Y.—The Public Service Commission has granted the Chasm Power Company permission to exercise its franchises for supplying electricity for lamps and motors in the towns of Belmont, Burke and Malone. The company has an electric plant in Chateaugay, with an output of 1100 hp, and furnishes electricity for both municipal and domestic lighting in this town.

CHESTER, N. Y.—The Chester Telephone Company has decided to make improvements and extensions to its system.

DUNKIRK, N. Y.—The Dunkirk Power & Heating Company has applied to the City Council for a franchise to use the streets and highways of the city for the transmission of electricity, mostly underground.

MANCHESTER, N. Y.—The Red Jacket Telephone Company is making arrangements to extend its system in the towns of Farmington and Manchester. About five miles of lines will be erected.

NEW YORK, N. Y.—The Third Avenue Railroad Company has placed orders with the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., for 4 1500-kw rotary converters and 12 550-kw air-blast transformers for the new substation, now under construction at Webster and Brook Avenues, in Borough of the Bronx.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, New York, N. Y., until Dec. 23, for furnishing material and labor for the complete conduit system, electric wiring and all other work in connection with the installation of an electric lighting and power system for certain buildings and grounds on Blackwell's Island, N. Y. Robert W. Hebberd is commissioner.

NEW YORK, N. Y.—Bids will be received until Dec. 21 by the Department of Education, New York, N. Y., for alterations and additions to electric equipment in Public School 13 on 216th Street and Willett Avenue, Williamsbridge, Borough of the Bronx. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent at the above office. C. B. J. Snyder is superintendent of school buildings.

NEW YORK, N. Y.—It is reported that the New York, New Haven & Hartford Railroad Company has awarded a contract to the Bradley-Gaffney-Steers Company, 1 Madison Avenue, New York, N. Y., for the general work in connection with equipping a six-line track from 129th Street, New York, to New Rochelle, to be operated by electricity. The work contemplated will involve an expenditure of about $30,000,000, and will include the construction of tunnels under the East River to Astoria, the erection of a large passenger station on the block bounded by Fourth and Lexington Avenues at Thirty-second and Thirty-third Streets, to be connected with the Pennsylvania tracks, and a large amount of electrical equipment.

NEW YORK, N. Y.—Bids for lighting the city for the year 1909 have been opened by Commissioner O'Brien, of the Department of Water Supply, Gas and Electricity. Electric arc lamps, of which there are 5838, will cost the same as this year. Of these, 5000 will cost $100 each per year. The New York Edison Company will furnish all over 5000 at $95 per lamp per year, and when the number reaches 7500 it will furnish all lamps at $95 per lamp. Double lamps will cost $130 each, the same as this year. Incandescent lamps will cost $22.50 each per year. The tungsten lamps, which are used on Riverside Drive, and of which there are 800 in Queens, Richmond and the Bronx, will cost the Borough of Manhattan $28 per lamp per year; in the boroughs of the Bronx, Queens and Richmond, about $30 each pear year. Electricity for heat and power in the public buildings, is six cents per kw-hour, the same as this year.

NIAGARA FALLS, N. Y.—Arrangements are being made by the Niagara Falls Hydraulic Power & Manufacturing Company for the installation of an additional unit in its power house. There are now eight 5000-hp units and one 10,000-hp unit in operation at the plant.

NYACK, N. Y.—The Public Service Commission has granted the Rockland Light & Power Company authority to execute a first mortgage on its property and franchises to extent of $1,000,000. The company will issue bonds to the amount of $500,000, the proceeds of $300,000 to be used to retire bonds maturing Nov. 21, 1941; $17,000 to acquire notes held by banks, and $15,000 to acquire outstanding bonds of the Nyack Gas, Light & Fuel Company, and the remainder for extension and betterments.

RENSSELAER, N. Y.—Plans are being made to organize a new telephone company in Rensselaer.

STITTVILLE, N. Y.—The citizens have voted to light the village by electricity, and a committee of five was appointed to consult with the Utica Electric Light Company in regard to terms. If satisfactory terms can be made, a lighting commission will be appointed by the Town Board to proceed with the arrangements.

UTICA, N. Y.—A copy of the order was filed with the United States District Court Dec. 7 by which the receivers of the Hudson River Electric Power Company lease to the Utica & Mohawk Valley Railway Company the steam electric plant in Utica and about 38 acres of land owned by the company, the substations at Little Falls, Frankfort and Oriskany and the transmission line from Utica to Clarks Mills for one year from Dec. 1, at an annual rental of $38,000. The railway company is to have the privilege of a renewal of the lease for another year from Dec. 1, 1909.

WADDINGTON, N. Y.—The New York & Ontario Power Company has applied to the Public Service Commission for permission to issue $1,850,000 in bonds and $664,741 in capital stock. As soon as its petition is granted the company will, it is said, place orders for machinery and equipment for its proposed plant. The present plans of the company calls for the development of 30,000 hp from the rapids of the St. Lawrence River, near Ogdensburg, N. Y. The company will at first make an installation of 17,200 hp, for which property and water rights have been secured. Beverly B. Tucker is consulting engineer and will have charge of equipment of the plant. George O. Van Kennen, of Ogdensburg, N. Y., is local representative of the company.

WHITE PLAINS, N. Y.—It is reported that work will begin within 60 days by the New York Central Railroad Company on equipping the two tracks of the Harlem Division from Wakefield to White Plains, to be operated by electricity, a distance of about 12 miles. This will give a through electric service from the Grand Central Station to White Plains.

AKRON, OHIO.—Thomas L. Childs, promoter of the Turkeyfoot Traction Company, has filed a mortgage in Akron, Ohio, in favor of the Youngstown Dollar Savings & Trust Company, of Youngstown, Ohio, to secure a bond issue of $400,000, the proceeds of which will be used for the construction of an electric railway between Akron and Turkeyfoot Lake, a pleasure resort.

CLEVELAND, OHIO.—The contract for the construction of the power house for the new court house has been awarded to H. W. Woodward, of the Cleveland Engineering Company, of Cleveland, Ohio, and French & Hubbard, of Boston, Mass., engineers.

PAINESVILLE, OHIO.—The new municipal electric light plant has been completed and put in operation. Bids will be received by the Board of Public Service until Jan. 5, 1909, for the purchase of the machinery, etc., of the old plant. W. N. Collister is superintendent of the municipal electric light plant.

ADA, OKLA.—A franchise has been granted to the Farmers' Independent Telephone Company to operate a telephone system in Ada.

MINCO, OKLA.—Plans and specifications for a municipal electric light plant and water works system, to cost approximately $30,000, are being prepared by Burns & McDonnell, of Kansas City, Mo.

OKEMA, OKLA.—Plans and specifications are being made for the installation of an electric lighting system to cost about $6,000. For further information address the city clerk.

MILTON, ORE.—An appropriation of $15,000 has been made to enlarge the municipal electric light plant.

OREGON CITY, ORE.—The Clackamas Land & Electric Company, recently organized, has filed for record deeds comprising 360 acres of land along the Clackamas River, below Estacada, where it will erect its proposed power plant, the cost of which is estimated at $500,000. Preliminary work has already commenced. Wirt Minor, of Portland, Ore., is interested in the enterprise.

PORTLAND, ORE.—F. S. Morris, of Portland, Ore., is reported to be interested in a project to erect a large power plant on the Clackamas River. The plant will have an output of 15,000 hp and will cost about $500,000.

PORTLAND, ORE.—The United Railways Company has filed on extensive water rights along East Dairy Creek, the water to be utilized for irrigation and to generate electricity for lighting and other purposes. The headgate is to be located at Denny Ford, 15 miles north of Hillsboro, where, it is said, the company proposes to erect its power house.

PORTLAND, ORE.—Only one bid was received for city lighting, which was submitted by the Portland Railway, Light & Power Company. The bid was for a five-year contract at the rate of $63.60 per arc lamp per year, and 3½ cents per kw-hour for electricity for incandescent lamps. It is estimated that the cost of incandescent lamps will be increased by more than $25,000 per year under the new rate. The rate for arc lamps is the same as paid under the present contract.

CATAWISSA, PA.—Plans are being considered to substitute tungsten street lamps for the present carbon filament lamps. W. O. DeWitt is superintendent.

SCRANTON, PA.—It is reported that work will commence at once on the construction of a new power house by the Scranton Railway Company. The plant will be located in the rear of the present plant, located on the Providence Road. The cost of the plant complete will be about $250,000 and will have an output of 2400 hp.

SLATEDALE, PA.—Application will be made to the Governor by H. W. Blose, C. J. Blose and Victor S. Wertman for a charter for the Slatedale Electric Light, Heat & Power Company. The company will be capitalized at $10,000 and proposes to construct a plant to cost about $15,000. Wilson Rex will be president of the company.

CENTRAL CITY, S. D.—The Village Trustees are considering the question of installing electric lamps on the road between the depot at Blacktail and Central City.

MONTEREY, TENN.—The city is reported to be advertising for bids for the construction of an electric light plant.

WHITESBURG, TENN.—Arrangements are being made to organize a local company to build an independent telephone line from Whitesburg to Glanmorgan, Va., a distance of 20 miles.

DALLAS, TEX.—Warren Wolfe, of Marble Falls, Tex., is reported to be interested in a project to build a dam across the Colorado River and erect a hydro-electric power plant, with an output of 16,000 hp.

McKINNEY, TEX.—Plans are being made to extend the municipal electric light system. Additional arc lamps will be installed. W. E. McKinnon, of Dallas, Tex., is superintendent.

SAN AUGUSTINE, TEX.—The San Augustine Light & Power Company is installing an electric plant in San Augustine. The equipment of the plant will include a 60-kw three-phase generator, a 75-hp Brownell engine and a Brownell boiler, with a rating of 80 hp. F. K. Nance, of Jacksonville, Tex., is president and manager.

TENAHA, TEX.—The City Council has granted a franchise to Lem Hill to install an electric light plant in Tenaha.

TERRELL, TEX.—Plans are being prepared for the construction of a municipal electric light plant to cost about $15,000.

LACEY, VA.—The Washington, Alexandria & Mt. Vernon Railroad Company is erecting a 600-kw substation at Lacey, Va., where it will soon erect car shops and car barn. The company has recently installed a 1000-kw turbine in its power plant to furnish electricity for the Falls Church division. The company leases the Falls Church Railroad.

PORTSMOUTH, VA.—Bascom Sykes, city engineer, writes that the city is considering the question of constructing an electric light plant for street lighting, etc.

CAMAS, WASH.—Two applications have been made to the City Council for franchises to install and operate an electric light system. Kelley Loe, representing outside capital, has applied for a 50-year franchise, and proposes to install a steam plant at Camas. The other application was made by G. S. Smith and A. P. Casey, both of Washougal, who propose to develop the water power of Washougal River and erect a plant between Camas and Washougal. The Council as yet has not taken action on the franchises.

CENTRALIA, WASH.—The Pacific Telegraph & Telephone Company contemplates extensive improvements to its local system, for which an appropriation of $35,000 has been made.

PORT ORCHARD, WASH.—A company has been formed to utilize the power of the Dosewallup River on the west side of the Hood Canal. It is proposed to install a power plant at a cost of $250,000 and to furnish electricity for lamps in the towns of Port Orchard, Bremerton, Charleston and other towns in Kitsap County.

SPOKANE, WASH.—Plans have been prepared by Albert Held, architect, for the Sacred Heart Hospital for installation of an electric plant to furnish electricity for lamps and motors in the hospital.

TACOMA, WASH.—The City Council has awarded a contract to the Seattle-Tacoma Power Company for furnishing electricity to operate the pumps at pumping station C. Under the terms of the contract the company is to furnish 1500 hp for four years at the rate of $20 per hp per year. The contract expires Nov. 8, 1912. The city is to erect its own transmission line and furnish its own transformers, the cost of which is estimated at about $16,000. The Tacoma Railway & Power Company offered to furnish the service over its own transmission line and furnish transformers at a cost of $29 per hp per year. A saving of about $8,000 will be made to the city through the contract made with the Seattle-Tacoma Power Company. H. J. McGregor, commissioner of public works, was authorized to make a contract with the Tacoma Railway & Power Company to furnish the service until the transmission line is completed at the rate of $32 per hp.

MORGANTOWN, W. VA.—The plant and holdings of the People's Telephone Company have been purchased by S. A. Moore, of Phillippi, for $71,000.

BRISTOL, WIS.—The Bristol Telephone Company contemplates making improvements and extensions to its system in the near future.

DE PERE, WIS.—The De Pere Electric Light & Power Company is planning to extend its transmission lines, involving an expenditure of about $2,500. L. L. Tessier is superintendent.

LA CROSSE, WIS.—The lighting committee of the Council has decided to secure an engineer to prepare plans and estimates for the construction of a municipal electric light plant.

MILWAUKEE, WIS.—Extensive improvements are contemplated by the Bell Telephone Company to its system in Wisconsin during the coming year which will involve an expenditure of $1,500,000. The company is planning to erect new toll lines from Milwaukee to Plymouth via Port Washington, Grafton and Sheboygan.

MILWAUKEE, WIS.—John I. Beggs, president of the Milwaukee Electric Railway & Light Company, has submitted a proposition to Mayor Rose and the special lighting committee of the Greater Milwaukee Association, offering to provide and install six electroliers to every block on Grand Avenue and Wisconsin Street between Eleventh Street and the lake, providing the city will pay for the electricity consumed and enter into a contract covering a period of sufficient length to pay the company for the expenditures. The plans provided that business men pay for the cost of lamps, posts and electricity consumed.

LARAMIE, WYO.—H. C. Taylor has applied to the Council for a franchise to operate an electric light system in this town.

CALGARY, ALB., CAN.—The City Council will be asked for an appropriation for preliminary surveys and expert opinion on the feasibility of a civic power development.

EDMONTON, ALB., CAN.—The City Council has decided that more cars are immediately necessary for the municipal electric street railway system. For further information, address Mayor Macdougall.

McLEOD, ALB., CAN.—The ratepayers voted in favor of spending $55,000 on improvements to the water works and electric lighting systems. For further information, address E. F. Brown.

VANCOUVER, B. C., CAN.—R. H. Sperling, general manager of the British Columbia Electric Street Railroad Company, states the company will build a line through the Town of Point Grey, providing satisfactory arrangements can be made with that municipality.

WINNIPEG, MAN., CAN.—An official of the Canadian Pacific Railroad Company states that the recent press dispatches to the effect that the company will equip certain lines to be operated by electricity in British Columbia are entirely erroneous. He admits the company would be willing to make the change providing a reduction in operating expenses would result, but says so far the company has not given the matter serious consideration.

NIAGARA FALLS, ONT.—The City Council has passed a by-law providing for a reduction in the price of electricity to consumers from $22 to $20 per horse-power per year. The reduction is made possible owing to the city securing electrical energy from the Ontario Power Company at a lower rate than it received from the Canadian Niagara Power Company. The price was originally $27 per horse-power per year.

PORT ARTHUR, ONT., CAN.—At the coming municipal elections the ratepayers will vote to decide whether the electrical and other public utilities under municipal control shall continue in the hands of a commission or be operated by a board of experts employed for the purpose. They will also vote on a by-law to provide $25,000 for improvements to that portion of the Port Arthur municipal street railway system running in this city.

SAULT STE. MARIE, ONT., CAN.—Work has begun on the reconstruction of the power plant of the Lake Superior Power Company, Sault Ste. Marie, Ont., which was destroyed by fire last spring, and when completed the plant will have an output of 6300 hp. New switchboards will be installed. L. H. Davis is engineer in charge of the work.

SIMCOE, ONT., CAN.—The Bell Telephone Company is making arrangements to put its wires in this city underground.

REGINA, SASK., CAN.—Messrs. Mackenzie, Brown, Thom & Frame, attorneys, are acting for a syndicate seeking a charter under the name of the Regina Inter Urban Tramway Company, which proposes to build an electric street car system around Regina and to adjacent towns.

New Industrial Companies.

THE SCHOLL ENGINEERING COMPANY, of Youngstown, Ohio, has been incorporated, with a capital stock of $1,000, by William J. Scholl, M. F. Whitehead, Henry R. Fothergill, E. G. Coronich, J. R. Rawson.

THE UNITED STATES POLE PRESERVING COMPANY, of Boston, Mass., has been chartered, with a capital stock of $4,000. The officers of the company are: Joseph D. Lowe, president, and Louis Auerbach, treasurer and clerk.

THE A. J. DEER COMPANY, of Hornell, N. Y., has been chartered, with a capital stock of $120,000, to manufacture motors, electric novelties and electric machinery, by Arthur J. Deer, of Buffalo, N. Y., Frank Bartz and Frederick A. Wygant, of Hornell, N. Y.

THE ELECTROMAGNETIC TOOL COMPANY, of Chicago, Ill., has filed articles of incorporation for the purpose of manufacturing electrical devices and tools. The company is capitalized at $50,000, and the incorporators are O. R. Barnett, P. H. Truman and H. L. Peck.

THE CHICAGO ENGINEERING & INSPECTION COMPANY has been incorporated by Gordon M. Proudfoot, A. Randolph Leland and J. H. Westover. The company is capitalized at $5,000, and proposes to carry on a general civil and mechanical engineering business.

THE POWER EQUIPMENT COMPANY, of Boston, Mass., has been incorporated, with a capital stock of $10,000, to install machinery of all

kinds. The officers of the company are: V. Frank Holmes, of Brookline, Mass., president; Maurice C. Tompkins, of Winchester, Mass., clerk.

THE WEST END CONTRACTING COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $1,000, and proposes to carry on a general contracting, civil, mechanical and electrical engineering business, and to manufacture electrical and other machinery.

THE SEYMOUR & BROWNSTOWN CONSTRUCTION COMPANY, of Indianapolis, Ind., has been incorporated, with a capital stock of $150,000, to construct steam and electric railroads, and to carry on a general construction business. A. K. Press, W. T. Devoor and L. P. Osenback are directors.

THE RADLEY STEEL CONSTRUCTION COMPANY, of Hornell, N. Y., has been chartered, with a capital stock of $50,000, by J. J. Radley, R. T. Brooks, W. W. Pease, of New York, N. Y. The company proposes to do a general mechanical and civil engineering business, and to manufacture engines, machinery, tools, etc.

THE ROCHESTER ELECTRIC & INSULATION COMPANY, of Rochester, N. Y., has filed articles of incorporation, with a capital stock of $50,000. The company proposes to manufacture electrical appliances and supplies. The incorporators are Patrick J. McDonald, George H. Smith and Harry C. Taylor, of Rochester, N. Y.

THE AMERICAN TELPHER COMPANY, of Buffalo, N. Y., has been chartered, with a capital stock of $300,000, by Herman R. Pease, Luther Hatch, John J. Tisdale, Barnet W. Harris, Reynold F. Penton, John G. Herb and Oliver O. Butcher, of Buffalo, N. Y. The company proposes to manufacture telpher apparatus for transporting goods.

THE INTERNATIONAL TELECHRONOMETER COMPANY, of Rochester, N. Y., has been incorporated, with a capital stock of $500,000, to deal in electrical supplies and engage in electrical work. The directors are Morton E. Lewis, James W. Lewis, George S. McMillan, Clarence McKay, of Rochester, N. Y., and Victor B. Deyber, of Albany, N. Y.

THE MONARCH STORAGE BATTERY COMPANY, of New York, N. Y., has been chartered, with a capital stock of $50,000, by Alexander D. Thornburn and Robert B. Hopkins, of New York, N. Y., and R. W. Phelps, of Buffalo, N. Y. The capital stock of the company is placed at $50,000 and it proposes to manufacture electrical and mechanical appliances.

THE ENOCHS ELECTRIC COMPANY, of St. Paul, Minn., has been incorporated, with a capital stock of $100,000, by Claude D. Enochs, Herbert Berreau and H. B. Downs. The company proposes to manufacture electrical apparatus.

THE JOHN H. DOREMUS COMPANY, of Passaic, N. J., has been chartered, with a capital stock of $25,000, to manufacture gas and electric fixtures, wood and slate mantels. The incorporators are: John H. Doremus, Alfred V. R. Doremus and Agnes S. Doremus, all of Passaic, N. J.

THE OKONITE COMPANY, of Passaic, N. J., has been incorporated, with a capital stock of $600,000, for the purpose of manufacturing wires and cables, rubber goods, electrical supplies. The incorporators are: Frank C. Jones, Willard L. Candee, H. Durant Cheever and John D. Cheever, all of New York, N. Y., and William F. Gaston, of Passaic, N. J.

New Incorporations.

SOLO, ARK.—The Raspberry Telephone Company has been organized for the purpose of constructing a telephone line from Raspberry to Solo. The officers are: John W. Hensley, president; John Willis, secretary, and B. Rudder, treasurer.

ATLANTA, GA.—Application has been made for a charter for the Atlanta Power Company by E. S. Neely, Alex. C. King and George Campbell.

RUPERT IDAHO.—The Settlers' Mutual Telephone Company has been chartered with a capital stock of $48,000 by L. R. Adams, Roy W. Adams and Charles C. Nelson.

INDIANAPOLIS, IND.—The Brownstown Water, Light & Traction Company has been incorporated, with a capital stock of $50,000. The company proposes to construct and operate water and light plants for municipal uses, and also for traction lines. W. B. Holton, Harley Jackson and Jas. B. Thompson are directors.

LADORA, IA.—The Farmers' Mutual Telephone Company has been chartered, with a capital stock of $20,000. M. W. Kelting is secretary.

WILTON JUNCTION, IA.—Articles of incorporation have been filed for the Moscow-Wilton Rural Telephone Company, with a capital stock of $500. H. H. Will, of Moscow, Ia., is secretary.

LEONARDSVILLE, KAN.—The Riley Mutual Telephone Company has filed articles of incorporation, with a capital stock of $10,000.

MERRYVILLE, LA.—The Merryville Telephone Company has been chartered, with a capital stock of $10,000, by J. O. Knight, B. H. Carroll, R. E. Welborn, W. A. Moore, M. E. Frazer and J. T. Stringer.

PORTLAND, MAINE.—The United States Light & Heating Company has been incorporated, with a capital stock of $17,500,000. The officers are: C. E. Eaton, president, and T. L. Croteau, treasurer.

BURR OAK, MICH.—The Burr Oak Mutual Telephone Company has been organized with a capital stock of $10,000.

PLEASANTON, MICH.—The Southeast Pleasanton Telephone Company has been formed and the following named officers elected: James M. Allen, president; Jones Babcock, vice-president and secretary, and O. Kirstead, treasurer.

ST. CLAIR, MICH.—The Lindsey Road Telephone Company has been organized to erect a farmers' telephone line to connect with the St. Clair exchange. The officers of the company are: Julius Beyer, president; Otto Bandlow, secretary, and August Guildenstein, treasurer.

ADVANCE, MO.—The Advance Telephone Company has been organized with a capital stock of $12,000 and the following named officers: J. H. Schonhoff, president; W. E. Finney, secretary and auditor. The company has taken over the property and holdings of the Puxico Central Telephone Company, which operated exchanges at Advance and Puxico.

ST. LOUIS, MO.—The Reliance Heating & Engineering Company has been incorporated by George H. Frank, Manuel J. Hanna, Gustav Strauss and Edmund Schaefer. The company is capitalized at $4,000 and proposes to operate a power plant for the transmission of heat, light and power.

PLEASANTVILLE, N. J.—Articles of incorporation have been filed for the Atlantic & Suburban Railway Company, with a capital stock of $650,000. The directors are: Robert Wetherill, of Chester, Pa., president; Garnett Pendleton, of Upland, Pa.; William S. Blakeley and Richard Wetherill, of Chester, Pa., and John R. Black, of Atlantic City, N. J.

NEW YORK, N. Y.—The Manhattan & Queensboro Railway Company has been chartered to operate three and one-half miles of electric railway from Eleventh Avenue and Fifty-seventh Street, New York City, to Thompson Avenue and Vandam Street in Long Island City, N. Y. The company is capitalized at $40,000, and the directors are: Michael J. Degnon, Charles G. Meyer, Arthur B. Turner, Francis Hilbert, Stewart W. Eames, William F. Hecken, of New York, N. Y.; William H. Williams, Jr., of Astoria, N. Y., and Clancy D. Boynton, of Perth Amboy, N. J. The principal office of the company is at 43 Exchange Place, New York City.

NEW YORK, N. Y.—The Queensboro Bridge & Jamaica Company has filed articles of incorporation, with a capital stock of $200,000, to operate an electric railway from the terminal at Forty-second Street and Park Avenue, Manhattan, to Union Hall and South Street and the proposed new Pennsylvania Railroad Station, Archer Place and Hillside Avenue and Wexford Terrace, on the property of the Jamaica estates, and at Pauldine Street in Queens County. The directors are: Michael J. Degnon, Charles G. Meyer, Arthur B. Turner, Francis Hilbert, Stewart W. Eames and William F. Hecken, of New York, N. Y.; William H. Williams, Jr., of Astoria, N. Y., and Clancy D. Boynton, of Perth Amboy, N. J. The principal office of the company is at 43 Exchange Place, New York City.

BEACH, N. D.—The Golden Valley Telephone Company has been incorporated, with a capital stock of $10,000, by J. P. Smith, of Sentinel Butte, N. D.; G. D. Lovell, Edward Hoverson and others, of Beach, N. D.

OAKES, N. D.—The Lakota Western Telephone Company has been chartered, with a capital stock of $200,000, by H. C. McCartney, of Oakes, and others. The company proposes to construct a telephone line from Palermo, N. D., to Havre, Mont.

EUFAULA, OKLA.—The Pioneer Electric & Power Company has been incorporated, with a capital stock of $9,500, by C. E. Foley, Philip Brown, G. H. Tulley and J. D. Primrose.

BLUE RIDGE SUMMIT, PA.—Application will be made Dec. 31 for a charter for the Blue Ridge Mountain Telephone Company by W. L. Maurer, George T. Oliver, A. B. Snively, D. C. Flohr and W. H. Decker.

GETTYSBURG, PA.—Articles of incorporation have been filed for the Adams County Electric Light, Heat & Power Company, with a capital stock of $5,500.

HARRISBURG, PA.—Articles of incorporation have been filed for the Blacktown Telephone Company, of Blacktown, Pa. The company is capitalized at $10,000.

HUNTINGDON, PA.—The Porter Township Telephone Company has been organized by the Bell Telephone Company to construct a telephone line into Huntingdon, Pa. The officers of the company are: John R. Leffard, president; Paul H. Neff, secretary, and Alfred Laird, agent.

WOMELSDORF, PA.—The Womelsdorf & Rehrersburg Rural Telephone & Telegraph Company has been incorporated, with a capital stock of $5,000, by A. M. Miller, H. D. Lebo, Martin S. Filbert, C. Blatt, William R. Nein, J. G. Reichert and others.

LEESVILLE, S. C.—The Brodie Light & Power Company has been chartered, with a capital stock of $10,000, by Furman E. Brodie, Claudia E. Brodie, of Leesville, S. C., and C. P. Quattlebaum, of Conway, S. C.

IPSWICH, S. D.—The Union Township Telephone Company has been incorporated, with a capital stock of $10,000, by S. W. Mount and others.

SOUTH SHORE, S. D.—The Antelope Valley Telephone Company has been incorporated by William Boice, F. A. Zirble and J. J. Fry to construct a telephone line in the Antelope Valley to connect with the South Shore exchange.

GLEASON, TENN.—The Gleason Rural Telephone Company has filed articles of incorporation, with a capital stock of $1,000. The incorporators are A. W. Brawner, L. W. Carter, W. H. Williams, J. B. Gatewood and others.

BURLINGTON, VT.—Articles of incorporation have been filed for the Burlington & Vergennes Traction Company for the purpose of constructing an electric railway from Burlington to Vergennes. The incorporators are: John J. Flynn, A. O. Humphrey, C. W. Brownell, Elias Lyman, L. E. Woodhouse, W. B. McKillip, of Burlington, Vt.; Edward P. Hatch, of New York, N. Y.; E. F. Genhardt and C. M. Russell, of Shelburne, Vt.

CLE ELUM, WASH.—Articles of incorporation have been filed for the Cle Elum-Roslyn Railway & Power Company, with a capital stock of $100,000, by Frank S. Farquhar and others.

STEVENSON, WASH.—The Skamania Co-operative Telephone Association has been incorporated, with a capital stock of $10,000, by A. Fleischauer and others.

SABIN, WIS.—Articles of incorporation have been filed for the Mill Creek Telephone Company.

DUNDURN, SASK., CAN.—The Dundurn Rural Telephone Company has been incorporated here. J. Burkitt, of Dundurn, Sask., is interested in the enterprise.

REGINA, SASK., CAN.—The Sunny Hill Rural Telephone Company has been incorporated here. E. J. Wright, of Regina, Sask., is one of the promoters.

Company Elections.

NORWICH, CONN.—The directors of the Norwich, Colchester & Hartford Traction Company have elected the following named officers: Costello Lippitt, president; Lucius Brown, secretary, and Henry W. Tibbitts, treasurer.

MONTREAL, QUE., CAN.—At the annual meeting of the Montreal Street Railway Company, held recently, the following named officers were elected: L. J. Forget, president; W. Blackwell, vice-president; W. G. Ross, managing director.

Legal.

TELEPHONE BOOTHS MUST BE CAPABLE OF BEING OPENED FROM THE INSIDE.—An employer must furnish reasonably safe appliances for the use of his employees. Under this rule a telephone booth, which, when closed, cannot be opened from the inside, does not measure up to the standard required by the law. In the case which brought up this question, there was no knob on the inside of the booth to be turned in opening the door. The plaintiff after using the booth tried to get the door open and could not do it, and finally got the booth loose from the wall and got out at the beak, but in so doing severely injured his hand. Upon a trial of the case before a jury, a verdict and judgment was rendered in his favor, fixing the damages at $4,500, and the company appealed. The Appellate Court held that the verdict was excessive in amount, and a new trial was ordered. But it was also held that the case was a proper one for the jury to determine. "If the box fit close to the wall," said the court, "and fresh air could not get into it as fast as a man could breathe it, it was not a safe place for a man to be shut up in; and the evidence for the plaintiff tended to show these facts, and also to show that in a short time a man would become unconscious if the box was closed. The master is not an insurer, but he is required to make the premises reasonably safe for the use of the servant. Under this rule a telephone booth should not be so constructed that it cannot be opened from the inside. The purpose of having the door was manifestly to shut out the noise of the machinery, and the plaintiff, therefore, properly shut the door that he might hear the person talking over the phone. When he found himself shut up in the box with no means of opening it, it was a question for the jury whether he used such care as might be expected of an ordinarily prudent person under the circumstances." Georgetown Water, Gas, Electric & Power Co. v. Forwood, Court of Appeals of Kentucky, 1135 S. W. Rep. 112.

TELEPHONE COMPANY NOT LIABLE FOR NEGLIGENCE WHERE AGENT IS EXONERATED FROM LIABILITY.—The plaintiff sued for damages for injuries, which he received while working for the defendants in the construction of a telephone line, by reason of the breaking of one of the poles through defects which rendered it unsuitable for the use for which it was intended. One of the defendants, a man named Rosenthal, admitted employing the plaintiff, but declared that in so doing he was acting as the agent of the other defendant, the telephone company. On behalf of the telephone company it was sought to be shown that Rosenthal was building the telephone line upon his own responsibility and not as agent of the telephone company; that his method was to construct such lines in the rural districts at his own risk and cost, and when constructed seek and obtain telephonic connection with the lines of the telephone company. Rosenthal, on the other hand, contended, and introduced evidence to show, that he was building the line for the telephone company, and in managing the work of construction he was acting as its agent. As to the occasion of the accident, it is not disputed that it resulted from the breaking of a telephone pole, the selection of which was not made, nor directly authorized to be made, by the telephone company, and that the selection was made by the defendant Rosenthal. On the trial, Rosenthal was absolved from liability and the company was held. But on an appeal taken by the company the judgment against the company was reversed. It was held that the employee's responsibility is primary and the employer's responsibility secondary in the sense that he has committed no moral wrong, but under the law is held accountable for his agent's conduct. While both may be sued in a single action, a verdict exonerating the agent must necessarily exonerate the principal, since the verdict exonerating the agent is a declaration that he has committed no wrong, and the principal cannot be responsible for the agent if the agent has committed no wrong. As between the company and its servants, the latter alone is the wrongdoer, and in calling upon him for indemnity, the company bases no claim upon its own misfeasance or default, but upon that of the servant himself. On the other hand, suppose the servant be directed by the officers of the company to do a certain act, which it turns out they had no right to do, and for doing which he is made to pay damages. Here, if the act was a plain and manifest wrong, the servant can have no indemnity, because he must have known the act to be unlawful; but if the act directed was one he had reason to suppose was legal, and he obeyed directions on that supposition, it would ill become the principal to demand that he be treated as a wrongdoer when called upon to indemnify him against the consequences of the act its officers had directed. In such a case the servant is not in morals a wrongdoer at all, and his claim to indemnity would be based upon a faithful obedience to orders, which he had a right to presume were rightful, nothing to the contrary appearing. Bradley v. Rosenthal, Supreme Court of California, 97 Pac. 875.

Educational.

A COLUMBIA DINNER—A dinner and meeting of the graduates in the department of mechanical engineering at Columbia University, for the purpose of organizing a permanent society, was held at Reisenweber's on Nov. 7, 1908. The aim of this society is to keep the graduates of this department in closer touch with each other and with the university and to work along the lines of the Stevens Institute organization. Meetings are to be held every other month, for which speakers prominent in engineering professions will be invited to give half-hour talks on engineering topics which would be of interest to the members. The officers of the society are: President, D. M. Meyers; secretary-treasurer, L. C. Biglow; meetings committee, J. J. Howell, T. J. Burch, J. C. Barnaby, R. C. Jones.

Obituary.

MR. L. E. MASON, Western representative of the Bryan-Marsh Company, with headquarters at Denver, Colo., died at the home of his sister at Monroe, Mich., on Nov. 28. Mr. Mason was one of the best-known salesmen of the West and was one of the pioneer roadmen of the Bryan-Marsh Company. He had been stationed at Denver for the past six years.

Personal.

MR. H. B. THAYER, president of the Western Electric Company, New York, N. Y., has sailed for Europe, but will not make a long stay on the other side.

MR. H. G. STOTT, superintendent of motive power of the Interborough Rapid Transit Company, New York, N. Y., is to address the Montreal Section of the American Institute of Electrical Engineers on Dec. 18.

MR. A. L. HAASE, the well-known representative of the Harvard Electric Company, of Chicago, has just sustained an irreparable personal loss in the death of his mother, Mrs. Eliza McGuire Haase.

MR. F. R. UPTON, formerly manager of the General Electric Company works at Harrison, N. J., and more latterly associated with the Edison cement interests, has gone to the south of Europe with his family and will there spend the winter.

MR. CHARLES R. HUNTLEY, president of the Buffalo General Electric Company, Buffalo, N. Y., on Dec. 12 addressed the members of the Ad Club of Buffalo, and in the course of his remarks he gave facts about the application of electric power to industrial Buffalo.

MR. HERBERT E. STONE has just become connected with the Dearborn Drug & Chemical Works as manager of sales in the eastern department, with headquarters in New York City. Mr. Stone was formerly president of the N. A. S. E. and recently manager of the Pittsburg office of the Chapman Valve Company. Mr. Stone will have associated with him a corps of able assistants.

MR. CAMILLO OLIVETTI, of Milan, Italy, whose electrical instruments are widely known throughout his own country and Europe generally, is on a visit to New York and will probably spend a month in the United States. He was last over here in 1893 with Prof. Ferraris, attending the Electrical Congress at Chicago and staying some time, so that he has a very good idea of things American. He is impressed with the growth and changes of the fifteen years.

Trade Publications.

REAMERS.—The Cleveland Twist Drill Company, Cleveland, Ohio, has issued a bulletin printed in two colors for drawing attention to its high-speed reamers.

RAILWAY AND MINE SUPPLIES.—The Ohio Brass Company, Mansfield, Ohio, has issued, as a supplement to its general catalogue No. 7, a

46-page publication dealing with railway and mine supplies, including hangers, section insulators, frogs, strain insulators, sanders and car couplers.

ROPE DRIVES are discussed in an instructive manner in the November issue of *Power and Transmission*, published by the Dodge Manufacturing Company, Mishawaka, Ind.

ELECTRIC HOISTS designed for lighting from 1 to 30 tons are listed and described in an illustrated catalogue issued by the Yale & Towne Manufacturing Company, 9 Murray Street, New York.

STEAM TURBINES.—Bulletin No. 5370 of the Western Electric Company contains much information concerning the constructive details of turbines of the Ratean type. Illustrations are given of turbo-generator units rated at 400, 500, 750, 2500 kw and 5000 hp.

FRICTION CLUTCHES.—The Hill Clutch Company, Cleveland, Ohio, has issued a supplement to its general catalogue on power transmission machinery, which describes and lists friction clutch pulleys and couplings, together with the necessary accessories and extra parts.

VOGEL EXHAUST SYSTEM.—The Natural Power Company, St. Louis, Mo., has issued a catalogue descriptive of its line of pressure and exhaust fans, and also a circular devoted to the Vogel exhaust system for household use, which employs an electrically driven type of "Enpeesee" fan.

CONSTRUCTION SPECIALTIES.—The Harvard Electric Company, 66 West Van Buren Street, Chicago, Ill., is sending out circulars describing the Harvard patent construction specialties, among which is the Harvard steel insulator pin, having a collapsible feature that allows it to conform to the inequalities of the thread of a glass insulator.

TRANSFORMER TESTING.—A well-prepared guide to the testing of transformers by central stations has been issued by the Fort Wayne Electric Works, Fort Wayne, Ind., as publication No. 5016. The methods of testing are divided into three parts, those relating to condition, performance and temperature, each of which is dealt with in detail.

AIR COMPRESSORS for industrial service are well described and illustrated in publication No. 386 of the National Brake & Electric Company, Milwaukee, Wis. The compressors are designed for driving by motors of either the direct-current or the alternating-curent type. These compressors are rated at from 10 to 450 cu. ft. of air per minute.

T. P. A. BULLETIN.—The Technical Publicity Association, of this city, is issuing a neat bulletin, and the November issue is full of interesting data as to the work of this vigorous and useful young society. On page three are some pithy remarks by President Redfield on the trade papers of Europe, of which from personal observation on the spot he is inclined to speak rather deprecatingly.

BEARINGS.—Much valuable engineering information concerning ball and roller bearings is contained in catalogue No. 24 of the Standard Roller Bearing Company, Philadelphia, Pa. Bearings for all purposes are described, the largest one being a thrust bearing for sustaining a load of 1,500,000 lb. at 100 r.p.m. Instructions are given for the proper application of ball and roller bearings.

EDUCATION PUBLICITY.—Under this title the New York Telephone Company has just issued in a large sheet form reproductions of its recent advertisements from the local newspapers. These "ads," which have attracted attention very generally, deal in a careful explanatory fashion with the details and nature of telephone service and what is involved directly and comparatively in the service of New York.

MILLING MACHINE.—A long, four-page folder, in brown and red, with tipped-in half-tone, deals with the new No. 515 "Acme Automatic" of the National Acme Manufacturing Co., of Cleveland, O. It will feed and mill 3 inches and has a chuck capacity of 9/16 in. The multiple spindles permit of eight operations at one time. It is intended to effect economy in the making of small duplicate parts from metal bars.

FRANKLIN BULLETIN.—The Franklin Electric Manufacturing Company, Hartford, Conn., has just issued its Bulletin No. 8, which gives a good deal of interesting and practical information about the lamps made by this company. The company manufactures tungsten, tantalum and carbon filament lamps in a variety of forms, suitable to different uses. The Novi lamp is especially adapted for the automobile. Femco reflectors are also referred to. The bulletin contains many illustrations of lamps.

"TRUMBULL CHEER," for December, issued by the Trumbull Electric Manufacturing Company, Plainville, Conn., is devoted to the Christmas idea and bears on its cover the portrait, possibly from life, of a jovial Santa Claus. The contents are bright and cheerful, with an abundance of sententious wisdom. One of the articles deals in the guaranteed advertising. Enclosed is a large "Circle T," the design associated with this excellent line of products in switches, cut-outs, panelboards, etc.

WESTINGHOUSE DIARY.—The fifth edition of the useful little Westinghouse diary is just out and will be more sought after than ever. It is issued by the Westinghouse company's publishing department. In the new edition there are fresh data on the following subjects: High pressure steam turbine, Leblanc condenser, low pressure steam turbine, mechanical stoker, mercury vapor lamps, meter testing, storage battery, single-phase railway systems, tungsten lamps, turbo pumps and blowers, Westinghouse-Nernst lamps. The Diary is handy for the pocket and has blank memoranda pages.

INDIRECT ILLUMINATION.—The National X-Ray Reflector Company, 247 East Jackson Boulevard, Chicago, Ill., has issued a pamphlet entitled "Eye Comfort Obtained by the 'I-Comfort' System of Indirect Illumination." Illustrations of the methods recommended for hanging inverted reflectors are given, as well as the essential conditions under which the "I-Comfort" system is the most effective. Data is included relating to the efficiency and operating cost of the reflectors manufactured by this company.

Business Notes.

ELECTRICAL SUPPLIES.—Mr. L. B. Cutler, of North Attleboro, Mass., is opening a supply department in connection with his contracting business and will be glad to receive catalogues and price lists.

J. STONE & CO., LTD.—In our report of Nov. 28 of the meeting of the Association of Car Lighting Engineers, page 1164, the reference in Mr. Darker's remarks to J. Snow & Co., London, was given inaccurately, the firm of J. Stone & Co., Ltd., Deptford, London, being meant.

THE AUTOMATIC SWITCH COMPANY has established at its New York office, 131 Liberty Street, a showroom, where every variety of automatic switches and controls are exhibited in operation. The company has brought out many new contrivances within the past year and is doing a large business in elevator and other automatic controls.

THE G. & W. ELECTRIC SPECIALTY COMPANY, Chicago, Ill., reports that practically all of the station valves and pot heads installed in the Gary plant of the United States Steel Corporation were of the G. & W. type. The order consisted of more than 300 pieces, of which 225 were of the T. S. type, and the balance of the order of the multiple-conductor M. O. type.

FRANK B. COOK, 239 W. Lake Street, Chicago, states that he has received the order for the protectors and frames for the new San Francisco Exchange. The order covers both main and intermediate frames of the Cook type and his No. 10 type of protector, which was first installed in St. Louis, Mo., in 1906, the installation being 16,000 pairs. Since the first installation the No. 10 protector has rapidly gained favor until at the present time he has sold over 200,000, not including this big order for San Francisco.

SCHUCHARDT & SCHUTTE, the well-known machinery house of Berlin, Vienna, Stockholm, St. Petersburg, Copenhagen, Budapest, London, New York and Shanghai, announces that it has opened a branch under its own name for the sale of machine tolls, wood-working machines and small tools at No. 14 Akashicho Tsukiji, Tokio, Japan. While Schuchardt & Schutte has been closely affiliated for several years with the machine tool trade in Japan through its direct representatives, the establishment of a branch selling organization is a further step in the expansion of the export trade in American machine tools with which this firm has been so directly identified. The Tokio branch is under the management of Mr. James G. Brown, who has spent several years in the Far East in the interests of this firm.

THE NEW PROCESS RAWHIDE COMPANY, Syracuse, N. Y., manufacturers of pinions and cut gears of all kinds, is about to construct a considerable addition to its present plant. The company has been operating its plant nights for two months, has at the present time the largest payroll in its history, and business is coming in faster than it can be taken care of advantageously in the present plant. The new addition, which is now under construction, will consist of two stories and a basement, 60 ft x 80 ft., extending east on Plum Street from the company's present plant. The construction is of steel and brick, with cement floors, and will increase the available floor space by over 13,000 sq. ft. The cost of the new building complete will be from $25,000 to $30,000 and the company has machinery on order for delivery during the next two months approximating $12,000, consisting principally of automatic turret lathes, bevel gear planers and grinding machines. An additional hardening furnace for treating automobile transmission gears and drive gears will also be installed. The company reports the total of the orders at present on its books to be in excess of any time in its history. Work on the addition is expected to be completed early in February.

CHICAGO ELECTRICAL SHOW.—The preliminary plans for the success of the fourth annual Electrical Show at the Coliseum in Chicago, beginning Saturday, Jan. 16, and running until Saturday, Jan. 30, have been practically perfected. This year's show will contain many unusual illuminating features, one of which will probably be lighting the Coliseum throughout by banks and clusters of tungsten lamps. Practically all of the exhibition space has been contracted for, and the management of the show is now devoting its attention to the minor details of arrangement which will make for the success of the undertaking. In addition to the list of manufacturers of electrical apparatus noted in these columns, the following named concerns have contracted for exhibit space: Commercial Appliance Company, Taussig & Babcock, Autolectric Sign Company, Hahl Automatic Clock Company, Peerless Light Company, Palm Engineering Company, Pacific Electric Heating Company, Duntley Manufacturing Company, National Automatic Advertising Company, Jewell Electrical Instrument Company, Roth Brothers Company, Crescent Company, H. W. Johns-Manville Company, Red Cross Antiseptic Company, Northern Electrical Manufacturing Company, A. W. Kratz, Illinois Electric Renovator Sales Company, Hurley Machine Company, Murphy Electricity Rectifier Company, American Electric Fuse Company, the Caloric Company and the Allis-Chalmers Company.

THE BRYAN-MARSH COMPANY recently shipped seven boxes containing 168 tungsten lamps from Warren, Ohio, to Minneapolis, Minn. In transit the boxes were almost demolished, and yet when the lamps enclosed were tested not one of them was found broken. This is given as an indication of what is being accomplished in the effort to overcome the fragile features of metallic filaments.

MR. E. H. HAUGHTON, Chicago manager of the Bryan-Marsh Company, has returned from a trip through the West, where he investigated the tungsten lamp situation along the Pacific Coast. He reports that as a result of the successful efforts of the manufacturers of tungsten lamps in making the filaments more substantial, this type of lamp can now be shipped across the continent without heavy loss by breakage. To show that the Pacific Coast is using large quantities of tungstens, Mr. Haughton stated that recently the Oakland Warehouse Company, Oakland, Cal., received over one of the trans-continental lines a shipment of a carload of tungsten lamps. Approximately 28,000 lamps were included in this shipment.

CENTRAL ELECTRIC PUBLICATIONS.—The Central Electric Company, Chicago, is distributing circulars illustrative of new fuse adapters, by the use of which the new code fuses can be used in old code fuse boxes, thus simplifying the carrying of stock. Accompanying the circular is a flyer descriptive of Edison type "Pony" and standard sign receptacles which should prove of interest to users and makers of signs. It has also issued two new folders on snap and pendant switches. A complete list is given of the various sizes and illustrations of several methods of insulation; also a folder descriptive of combination reels and carts. The construction adopted is particularly well suited for the use of telephone, telegraph, electric light and street railway companies.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 8, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

905,837. ELECTROLYTE; Edward C. Broadwell, Chicago, Ill. App. filed Aug. 20, 1906. Coats metal with an ornamental coating by means of an electrolyte containing zinc sulphate, zinc naphthalene disulphonate and a small percentage of aluminum sulphate.

905,848. ELECTRIC-MOTOR CONTROL SYSTEM; William Cooper, Wilkinsburg, and Olof A. Sandborgh, Swissvale, Pa. App. filed Jan. 3, 1906. For operating cars equipped with the Westinghouse system in the same train with cars controlled by the Sprague system. Makes use of a relay switch group controlled from a master switch supplied from the motor supply circuit and a control system energized from a storage battery which is governed by the relay switch group.

905,854. TESTING SYSTEM FOR TELEPHONE LINES; William W. Dean, Chicago, Ill. Makes use of a plurality of cord circuits, a testing device common to said circuits, the circuit of said device being independent of the circuit of the operator's listening set, supervisory signal controlling magnets for the cord circuits, listening keys for the cord circuits, the connection of the testing device with the cord circuits being controlled through the medium of the keys.

905,868. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINES; I. L. Griffith, Pittsburg, Pa. App. filed June 28, 1905. Provides supports for those portions of armature coils which project beyond the core slots of the machine. The support comprises a pair of insulating strips, a supporting bracket and a base plate.

905,873. CABLE HANGER; Clement Guernsey Harrington, Maplewood, Mo. App. filed May 20, 1908. A sheet-metal suspension hook member is provided with a bent and perforated end portion and an expansible locking spring catch extends beyond its opposite end and enters said perforation.

905,875. CAR-TESTING DEVICE; Albert B. Herrick, Ridgewood, N. J. App. filed May 31, 1905. For testing the insulation, etc., in cars. Makes use of an electric measuring device, a variable resistance mounted upon a frame, connections including a series of plug terminals accessible from the front of the frame and a movable protecting plate provided with a series of apertures which register with certain plug terminals and obstruct others.

905,889. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINERY; B. G. Lamme, Pittsburg, Pa. App. filed June 28, 1905. For supporting the coil ends in the armatures of high-speed turbo-generators. Makes use of a ring, a plurality of detachable supporting brackets with seats to receive the outer side of the ring to prevent radial and longitudinal movement thereof.

905,900. WINDING FOR DYNAMO-ELECTRIC MACHINES; G. R. Maxwell, Pittsburg, Pa. App. filed June 16, 1905. Relates to the end connections of armature windings for polyphase generators, the object being to maintain an equality in the amount of copper in the windings corresponding to the several phases and to permit the removal of a coil for repairs. All portions of the end connectors, except the extremities, are concentric with the axis, and the connectors of each group are partially under the preceding and partially over the succeeding adjacent group.

905,905. ELECTRIC CUTOUT AND HOLDER; T. E. Murray, New York, N. Y. App. filed March 13, 1908. Does away with the ordinary electric fuse and prevents unauthorized access to circuit terminals and theft of current by providing a holder with two recesses, terminals in the recesses and a cutout in open eye shape, whose ends close the recesses. A removable locking bar provided with a seal to prevent removal of the bar locks the parts together.

905,907. TRANSMITTER BRACKET; Ernst S. McLarn, New York, N. Y. App. filed June 10, 1908. The transmitter is mounted on an arm, which is in turn mounted upon a bracket, consisting of sheet metal provided with larger and smaller bosses, the arm being pivoted in the bracket between the bosses. A clamping screw adjusts the pressure of the bosses on the arm.

905,922. ELECTRICAL APPARATUS; Karl C. Randall, Edgewood Park, Pa. App. filed April 5, 1907. Mounts a transformer and a circuit interrupter in a tank containing insulating oil, thus doing away with the porcelain bushings between transformer and circuit interrupter.

905,930. TWO-PHASE, ALTERNATING-CURRENT DISTRIBUTION; Herbert Sidney Russell, Hanwell, and F. E. Berry, West Drayton, England. App. filed May 6, 1907. Relates to a two-phase distributing system with a common return for both phases of the current. Provides a method of boosting by using a booster transformer having its boosted winding in the common return and its boosting or primary winding connected with the separate phase conductors.

905,933. ELECTRIC CIRCUIT MAKING AND BREAKING DEVICE; John Ryan, Columbus, Ohio. App. filed June 8, 1907. Signal flasher for signs, including a rotary shaft carrying segments, a plurality of pivoted arms riding over the segments and pivoted in an insulating block, headed members carried by the block and passing through the arms.

905,934. ELECTRICITY METER; Gustave A. Scheeffer, Indianapolis, Ind. App. filed Jan. 15, 1907. Relates to the armature coil of an induction wattmeter, which is built up of previously wound and formed coils that embrace and are interlocked to the disk of the meter. Three coils, each being at one side of the shaft and locked between two of three locking projections, are used.

905,935. SPARKER DEVICE; Erich Schietzel, Wilkes-Barre, Pa. App. filed Jan. 8, 1908. For igniting charges in mines. Makes use of a solenoid magnet, whose plunger can be set by hand, and which operates the contacts.

905,940. HIGH-TENSION INSULATOR; Guido Semenza, Milan, Italy. App. filed Feb. 5, 1906. A high-tension insulator made up of a series of petticoated sections. The top section has a wide flat rim and a lower wide flat-rim section is arranged beneath it with an intermediate distance piece connecting the sections.

905,952. GALVANIC CELL; J. T. Szek, London, England. App. filed Sept. 23, 1907. An expanded sheet-metal electrode for a galvanic cell in which the metal is made from a slotted sheet which is expanded transversely to make honeycomb-like openings and to twist the strips between the slots.

905,966. PROCESS AND APPARATUS FOR TESTING WATT-METERS; Edgar M. Wilkins, Mexico, Mex. App. filed Aug. 12, 1907. For testing watt-hour meters of the integrating induction type. Makes a spot or mark on the rotary element of the meter, rotates it under any desired load, discloses to view the angular position of the spot after a fixed interval, and compares the amount of movement with the proper angular movement, thus deducing the fact of acceleration or retardation.

905,969. ELECTRIC TERMINAL POST; A. G. Wilson, Wilkinsburg, Pa. App. filed Oct. 10, 1907. Carbon contact for use in relays for railway switches. An electrical terminal post including spring jaws, a cylindrical carbon partly enclosed by the jaws, and mechanical means for adjustably holding the contact together with a movable brush which contacts with the exposed surface of the carbon.

905,971. SYSTEM FOR ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed Nov. 13, 1907. Rotary converter for converting from direct to alternating currents and vice versa, including an alternating-current armature in its field for developing between the transforming apparatus and the alternating-current surface an alternating-current e.m.f. having a component at right angles to that of the transforming apparatus and means responsive to the electrical condition of the alternating current for controlling the field.

905,976. TROLLEY-WIRE HANGER; W. S. Arnold, Lorain, Ohio. App. filed June 18, 1908. Permits the wire to have a free movement relative to the supporting wire, so that the passage of the trolley along the wire will not break the wire at the ends of the clamping portion of the hanger. The hanger consists of a piece of sheet metal with arms having hooks which receive a supporting wire.

905,995. ALTERNATING-CURRENT MOTOR; Ernst Danielson, Stopsjon, Fogdhytton, Sweden. App. filed June 24, 1907. A dynamo for three-phase operation having a distributed winding comprising distinct sets of coils, connected in two equal phases and a transformer adapted for T-connection with the two phases to produce a balanced three-phase voltage.

905,998. ELECTRIC OUTLET BOX; C. J. Dorff, Chicago, Ill. App. filed June 22, 1907. Provides a closure so that the opening may be readily cleared when desired. Makes use of a box having an opening, a plug lying in the opening and having a peripheral fin, portions of the fin being bent to overlie the edges of the opening.

906,011. PRECIPITATING APPARATUS; John E. Greenawalt, Denver, Col. App. filed April 3, 1905. Precipitates gold and silver from chlorin solutions. Makes use of tanks arranged one above the other, each having a perforated floor with a porous jar suspended from the top of each tank and projecting therein. The solution is forced upwardly through the floor of the tank through a mass of zinc shavings on the floor in a direction opposite the flow of current.

906,003. INSULATOR PIN; Charles G. Ette, St. Louis, Mo. App. filed Jan. 15, 1908. Constructed so that the expansion of the metal of the pin will not cause the insulator to break. A piece of yielding material is arranged in an opening in the head of the pin and projects beyond the threads on the head so that it will be engaged by the screw thread of the insulator.

906,012. RAILWAY SWITCH AND SIGNAL APPARATUS; Lawrence Griffith, Yonkers, N. Y. App. filed Sept. 20, 1905. Electro-pneumatic system, including a plurality of motion plates and a controlling device therefor with means whereby upon a movement of the controlling device in either direction the motion plates will be moved one after the other in the same order.

906,038. TROLLEY CONTACT; A. R. K. Lauder, Schenectady, N. Y. App. filed March 27, 1908. Improvement on a prior application. The trolley contact comprises a round, flat strip conductor separated from the trolley wire, and engaged by the rims of the wheel in passing. In addition thereto, there is provided a resilient strip pressed down upon the conducting strip so as to exert a distributed pressure to hold the conducting strip in engagement with the wheel.

906,055. AXLE-LIGHTING SYSTEM; A. McGary, La Grange, Ill. App. filed Aug. 11, 1905. Relating to a system using a storage battery and generator, the latter driven by the car axle. Keeps the voltage constant instead of the current. The generator has a duplex armature, one part devoted to the working circuit and one to the storage battery.

906,056. AXLE-LIGHTING SYSTEM; A. McGary, La Grange, Ill. App. filed Oct. 22, 1906. Improvement along the lines of 906,055 to the same inventor.

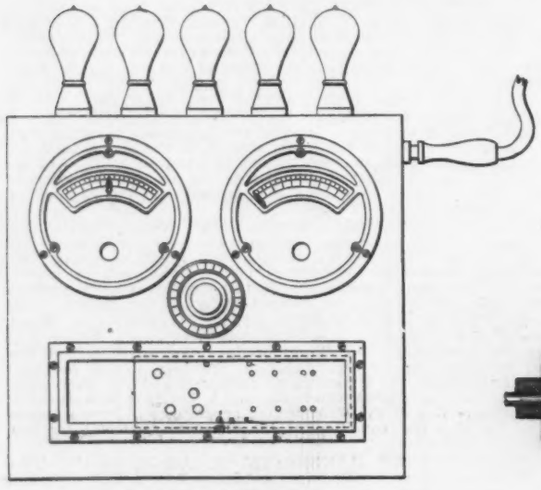
906,081. APPARATUS FOR THE PRODUCTION OF OZONE; Jan Steynis, New York, N. Y. App. filed Jan. 24, 1908. Silent discharges of electricity from hollow electrodes produce ozone. The electrodes are cooled by the use of a liquified gas, which, in expanding, absorbs the heat.

906,100. INDICATOR; E. J. Burke, New York, N. Y. App. filed Aug. 1, 1906. Provides a means for indicating the number of a calling party in a telephone system and reduces the number of relays in use. Combines a plurality of jacks with a normally rotating shaft, an indicator normally connected to the shaft, means for disconnecting the indicator pointer from the shaft when the pointer points toward a jack, a plurality of plugs for the jacks, which are adapted to permit the pointer to connect with the shaft when a plug is in circuit in the jack of a calling subscriber.

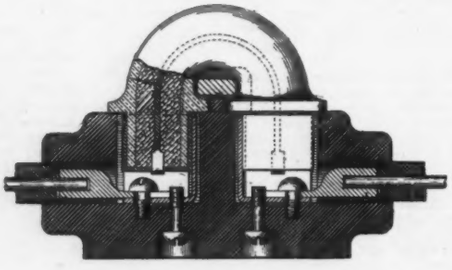
906,102. ART OF PRODUCING PIGMENTS BY ELECTROLYSIS; E. D. Chaplin, Boston, Mass. App. filed Feb. 3, 1906. Makes white lead by maintaining the lead solution and the alkaline hydrate separate and provides an oxidizing agent to prevent the formation of insoluble salts of lead in the electrolyzer.

906,103. ART OF PRODUCING LEAD SALTS BY ELECTROLYSIS; E. D. Chaplin, Boston, Mass. App. filed Feb. 3, 1906. Makes white lead by casting crude lead to produce the anode of an electrolyzer containing an electrolyte, which, under the influence of the electric current, separates into a solvent of lead and an alkaline hydrate. By contact deposition, the other metals are recovered from the lead solution, and the remainder is converted into the lead carbonate, or the like.

906,104. ELECTROLYTIC APPARATUS; E. D. Chaplin, Boston, Mass. App. filed Feb. 3, 1906. Apparatus for carrying out an electrolytic process of making white lead. Makes use of a supply tank and a number of electrolytic cells arranged at successively lower levels and having their electrodes connected in series with a high-potential



905,875—Car Testing Device.



905,905—Electric Cut-out and Holder.

906,274. ELECTRIC INDICATOR; Carl Von Peez, Vienna, Austria-Hungary. App. filed Oct. 4, 1907. For calling the servants in a hotel. A rotatable indication carrier with teeth is controlled by an armature which engages the teeth, an electromagnet and key. Means are provided for preventing the repeated operation of the armature until after a predetermined period.

906,279. TROLLEY CUTOUT; C. C. Phillips, Owensboro, Ky. App. filed May 9, 1907. Throws the broken portion of a trolley wire out of circuit to prevent injury to pedestrians, etc., by special construction of trolley and hanger.

906,296. INSULATOR; C. Rosenberg and V. T. Bailey, New York, N. Y. App. filed March 18, 1908. For incandescent lamps to relieve the binding screws from strain. Posts are provided at opposite sides of the base with a socket in the base and a cover for the socket and posts.

906,317. ALTERNATING-CURRENT SWITCH; F. W. Smith and Louis Larsen, New York, N. Y. App. filed May 25, 1907. The electromagnet has a movable core with transmitting mechanism between the core and the switch. A pivoted bifurcated lever controls the switch and is operated by the core, forming a kind of lost motion connection so as to permit the core to be freely vibrated, due to alternations in the current without moving the switch.

906,331. ELECTROMAGNETIC VALVE-OPERATING MECHANISM; J. B. Struble and E. R. Coe, Wilkinsburg, Pa. App. filed Nov. 7, 1907. For operating the air valve of an electropneumatic signaling system. Includes a solenoid coil, a plunger actuated thereby, a member extending through the plunger, links connected to the plunger and a yoke connected to the links and the member.

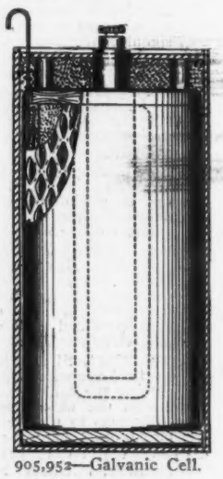
906,338. PROCESS OF PRODUCING SILICON; F. J. Tone, Niagara Falls, N. Y. App. filed Sept. 14, 1907. Mixes aluminum silicate and carbon in a special way, electrically heats the mixture and then separates the silicon from the alumina.

906,339. COMPOSITION OF MATTER CONTAINING ALUMINA AND SILICA; F. J. Tone, Niagara Falls, N. Y. App. filed March 17, 1908. Makes a hard, abrasive material consisting of a fused mass of alumina and silica, the material being free from basic impurities and containing between 5 and 35 per cent of silica.

906,361. ELECTRIC SWITCH; B. W. Allen, Boston, Mass. App. filed April 6, 1908. Relates to switches in which the lights on an electrolier may be put into circuit one, two, or more at a time, or all extinguished by the rotation of a barrel operated by a knob outside the chandelier. Details.

906,370. CONNECTOR FOR ELECTRICAL CONDUCTORS; Charles W. Beck, Rockville Center, N. Y. App. filed March 12, 1908. The connector includes two members pivotally connected at their outer end and provided with registering recesses to receive a binding post, one of the members having a socket at its inner end to receive a conductor, and the binding post being located in a socket arranged near the pivot.

906,386. ROTARY SNAP-SWITCH; C. A. Clark, Hartford, Conn. App. filed Oct. 24, 1907. Details in the construction of a snap-switch which does away with the ratchet and pawl and provides an interlock to permit tensioning of the contact bar to make a quick make and break.



905,952—Galvanic Cell.

dynamo. Prevents short-circuiting of the generator by discharging from an anode compartment at a higher level to the next anode compartment at a lower level, and from a cathode compartment into a compartment between diaphragms of the next cell at a lower level.

906,129. ELECTRIC APPARATUS FOR RAILWAY SWITCHES, SIGNALS AND THE LIKE; Lawrence Griffith, Yonkers, N. Y. App. filed April 8, 1903. Along the lines of 906,012. Makes use of a single indicating magnet, a controller moved by the magnet, means for preventing the final movement of the controller until it is actuated by the energizing of the indicating magnet.

906,161. TROLLEY DEVICE; Frank A. Robbins, Worcester, Mass. App. filed Nov. 11, 1907. Prevents the wire from getting between the wheel and the harp. The harp has inwardly extending lips and the flanges of the wheel are wider than the distance between the lips.

906,166. CAR SIGNAL; William H. Schweizer, Baltimore, Md. App. filed Oct. 8, 1907. Warns the motorman when the passenger is preparing to alight from the rear platform by closing a circuit closed by the weight of the passenger as he alights.

906,172. PROCESS OF SMELTING ALUMINUM ORES; F. J. Tone, Niagara Falls, N. Y. App. filed Sept. 14, 1907. Smelts aluminum silicate in an electric furnace with a reducing agent, such as carbon and iron.

906,173. METHOD OF TREATING ALUMINUM SILICATE; F. J. Tone, Niagara Falls, N. Y. App. filed March 17, 1908. Mixes aluminum silicate with an amount of carbon insufficient to reduce all the silicon, heats in an electric furnace so as to reduce a portion of the silicon, and fuses the alumina-silica residue into a hard, abrasive material.

906,211. REGULATION OF THE PERIOD OF INDUCTANCE OF HIGH-FREQUENCY CIRCUITS; Gustave Ferrie, Paris, France. App. filed May 8, 1907. An annular, hollow conductor with a transverse gap contains within it a conductor which is interposed in the circuit. Means are provided for regulating the resistance of the hollow conductor.

906,238. RAILWAY SIGNAL; M. M. Kane, Montgomery, Ala. App. filed Nov. 2, 1907. A semaphore which operates to display different colors controlled by an electromagnet. The blade carries a plurality of reversible wings adapted to show different colors in different positions.

906,405. MEANS FOR ELECTRICAL TRANSMISSION OF DESIGNS, FIGURES AND PHOTOGRAPHS; G. J. De Guillen Garcia, Barcelona, Spain. App. filed Feb. 28, 1908. Wireless or wire system for transmitting pictures. The sending drum is covered with the picture in relief and actuates a stylus that moves a circuit-closer in the path of one of a series of make and break wheels. The wheels have make and break projections differing in number from each other, so as to produce points or lines on the receiving surface, more or less separated from each other, which reproduce the shadows. Sending and receiving drum are kept in synchronism.

906,408. TOOL FOR ELECTRIC LAMP SOCKETS; G. W. Goodridge, Bridgeport, Conn. App. filed May 28, 1908. For fitting lamp sockets into ornamental shades. Particularly designed to go with applicant's prior patented structure. The tool has a hollow handle and a head, so that the wires may be threaded through it, the head being adapted to fit into a socket cap, to rotate it.

906,448. TERMINAL FOR ELECTRIC WIRES; Bernard Morgan, Newport, R. I. App. filed Feb. 6, 1908. Formed of a single piece of sheet metal which is adapted to be connected to the spark plug, and which is provided with wings to connect it to the conducting wire.

906,468 PROCESS FOR THE PRODUCTION OF OZONE; Jan Steynis, New York, N. Y. App. filed Jan. 24, 1908. Process of producing ozone in which he makes use of the apparatus of his above patent. Ozonizes by streaming discharges and causes successive cooling actions by evaporating liquified gas.

906,492. SAFETY DEVICE FOR RAILWAY SWITCH AND SIGNAL APPARATUS; Lawrence Griffith, Yonkers, N. Y. App. filed Nov. 5, 1904. See patents above referred to to same inventor. A motor drives the motion plate and electric means separate from an indicator prevent action of the indicator while energy is supplied to the motor.

906,498. SHUNT OR ELECTRICAL RESISTANCE; Edward Weston, Newark, N. J. App. filed March 15, 1907. Improvement in the well-known Weston shunts; connects to the terminal blocks of the shunt one or more short conductors of high specific resistance, so that they will dissipate practically all of the heat developed by the current in the exposed portions between them.

THE ELECTRICAL WORLD'S

MOONLIGHT TABLES FOR 1909

COMPILED BY H. W. FRUND

These schedules are made up on local mean time. Where standard time is used, and it varies considerably from sun time the proper deduction or addition must be made.

JANUARY, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	1 15 A.M.	1	6.20 A.M.	1	1.15 A.M.	1	6.20 A.M.
1	5.15 P.M.	1	12.00 M.	2	2.25 "	2	6.20 "
2	2.25 A.M.	2	6.20 A.M.	3	3.30 "	3	6.20 "
2	5.15 P.M.	2	12.00 M.	4	4.30 "	4	6.20 "
3	5.15 "	3	12.00 "	5	No light.	5	No light.
4	5.15 "	4	12.00 "	6	No light.	6	No light.
5	5.15 "	5	12.00 "	7	No light.	7	No light.
6	5.15 "	6	12.00 "	8	5.20 P.M.	8	7.50 P.M.
7	5.20 "	7	12.00 "	9	5.20 "	9	8.50 "
8	5.20 "	8	12.00 "	10	5.20 "	10	9.50 "
9	5.20 "	9	12.00 "	11	5.20 "	11	10.50 "
10	5 20 "	10	12.00 "	12	5.25 "	12	11.50 "
11	5.20 "	11	12.00 "	13	5.25 "	14	12.45 A.M.
12	5.25 "	12	12.00 "	14	5.25 "	15	1.45 "
13	5.25 "	14	12.45 A.M.	15	5.25 "	16	2.45 "
14	5.25 "	15	1.45 "	16	5.30 "	17	3.50 "
15	5.25 "	16	2.45 "	17	5.30 "	18	5.00 "
16	5.25 "	17	3.50 "	18	5.30 "	19	6.05 "
17	5.30 "	18	5.00 "	19	5.30 "	20	6.15 "
18	5.30 "	19	6.05 "	20	5.30 "	21	6.15 "
19	5.30 "	20	6.15 "	21	5.35 "	22	6.15 "
20	5.30 "	21	6.15 "	22	5.35 "	23	6.15 "
21	5.35 "	22	6.15 "	23	5.35 "	24	6.15 "
22	5.35 "	23	6.15 "	24	5.35 "	25	6.15 "
23	5.35 "	24	6.15 "	25	5.40 "	26	6.10 "
24	5.35 "	25	6.15 "	26	9.55 "	27	6.10 "
25	5.40 "	26	6.10 "	27	11.05 "	28	6.10 "
26	5.40 "	27	6.10 "	28	———	—	———
27	5.40 "	28	6.10 "	29	12.15 A.M.	29	6.10 A.M.
28	5.40 "	29	6.10 "	30	1.20 "	30	6.10 "
29	5.45 "	30	6.10 "	31	2.30 "	31	6.10 "
30	5.45 "	30	12.00 M.				
31	1.20 A.M.	31	6.10 A.M.				
31	5.45 P.M.	31	12.00 M.				

FEBRUARY, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date	Light.	Date.	Exting.
1	3.30 A.M.	1	6.05 A.M.	1	3.30 A.M.	1	6.05 A.M.
1	5.45 P.M.	1	12.00 M.	2	4.25 "	2	6.05 "
2	5.45 "	2	12.00 "	3	No light.	3	No light.
3	5.45 "	3	12.00 "	4	No light.	4	No light.
4	5.45 "	4	12.00 "	5	No light.	5	No light.
5	5.50 "	5	12.00 "	6	5.50 P.M.	6	7.40 P.M.
6	5.50 "	6	12.00 "	7	5.55 "	7	8.40 "
7	5.55 "	7	12.00 "	8	5.55 "	8	9.40 "
8	5.55 "	8	12.00 "	9	5.55 "	9	10.40 "
9	5.55 "	9	12.00 "	10	5.55 "	10	11.35 "
10	5.55 "	10	12.00 "	11	6.00 "	12	12.35 A.M.
11	6.00 "	12	12.35 A.M.	12	6.00 "	13	1.35 "
12	6.00 "	13	1.35 "	13	6.00 "	14	2.40 "
13	6.00 "	14	2.40 "	14	6.05 "	15	3.45 "
14	6.05 "	15	3.45 "	15	6.05 "	16	4.50 "
15	6.05 "	16	4.50 "	16	6.05 "	17	5.50 "
16	6.05 "	17	5.50 "	17	6.05 "	18	5.45 "
17	6.05 "	18	5.45 "	18	6.10 "	19	5.45 "
18	6.10 "	19	5.45 "	19	6.10 "	20	5.45 "
19	6.10 "	20	5.45 "	20	6.10 "	21	5.45 "
20	6.10 "	21	5.45 "	21	6.10 "	22	5.40 "
21	6.10 "	22	5.40 "	22	6.10 "	23	5.40 "
22	6.10 "	23	5.45 "	23	6.15 "	24	5.40 "
23	6.15 "	24	5.45 "	24	10.00 "	25	5.35 "
24	6.15 "	25	5.35 "	25	11.15 "	26	———
25	6.15 "	26	5.35 "	26	———	—	———
26	6.15 "	27	5.35 "	27	12.20 A.M.	27	5.35 A.M.
27	6.15 "	28	5.35 "	28	1.25 "	28	5.30 "
28	6.20 "	28	12.00 M.				

MARCH, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	2.20 A.M.	1	5.30 A.M.	1	2.20 A.M.	1	5.30 A.M.
1	6.20 P.M.	1	12.00 M.	2	3.15 "	2	5.30 "
2	3.15 A.M.	2	5.30 A.M.	3	4.00 "	3	5.30 "
2	6.20 P.M.	2	12.00 M.	4	No light.	4	No light.
3	6.20 "	3	12.00 "	5	No light.	5	No light.
4	6.25 "	4	12.00 "	6	No light.	6	No light.
5	6.25 "	5	12.00 "	7	No light.	7	No light.
6	6.25 "	6	12.00 "	8	6.25 P.M.	8	8.30 P.M.
7	6.25 "	7	12.00 "	9	6.30 "	9	9.30 "
8	6.25 "	8	12.00 "	10	6.30 "	10	10.30 "
9	6.30 "	9	12.00 "	11	6.30 "	11	11.30 "
10	6.30 "	10	12.00 "	12	6.30 "	13	12.30 A.M.
11	6.30 "	11	12.00 "	13	6.30 "	14	1.30 "
12	6.30 "	13	12.30 A.M.	14	6.35 "	15	2.35 "
13	6.30 "	14	1.30 "	15	6.35 "	16	3.40 "
14	6.35 "	15	2.35 "	16	6.35 "	17	4.35 "
15	6.35 "	16	3.40 "	17	6.35 "	18	5.05 "
16	6.35 "	17	4.35 "	18	6.35 "	19	5.05 "
17	6.35 "	18	5.05 "	19	6.40 "	20	5.00 "
18	6.35 "	19	5.05 "	20	6.40 "	21	5.00 "
19	6.40 "	20	5.00 "	21	6.40 "	22	5.00 "
20	6.40 "	21	5.00 "	22	6.40 "	23	4.55 "
21	6.40 "	22	5.00 "	23	6.45 "	24	4.55 "
22	6.40 "	23	4.55 "	24	6.45 "	25	4.55 "
23	6.45 "	24	4.55 "	25	10.10 P.M.	26	4.50 "
24	6.45 "	25	4.55 "	26	11.15 "	27	4.50 "
25	6.45 "	26	4.50 "	27	———	—	———
26	6.45 "	27	4.50 "	28	12.20 A.M.	28	4.50 A.M.
27	6.45 "	28	4.50 "	29	1.15 "	29	4.50 "
28	6.50 "	29	4.50 "	30	2.00 "	30	4.45 "
29	6.50 "	29	12.00 M.	31	2.40 "	31	4.45 "
30	2.00 A.M.	30	4.45 A.M.				
30	6.50 P.M.	30	12.00 M.				
31	2.40 A.M.	31	4.45 A.M.				
31	6.50 P.M.	31	12.00 M.				

APRIL, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	6.50 P.M.	1	12.00 M.	1	3.10 A.M.	1	4.45 A.M.
2	6.55 "	2	12.00 "	2	No light.	2	No light.
3	6.55 "	3	12.00 "	3	No light.	3	No light.
4	6.55 "	4	12.00 "	4	No light.	4	No light.
5	6.55 "	5	12.00 "	5	No light.	5	No light.
6	6.55 "	6	12.00 "	6	6.55 P.M.	6	8.20 P.M.
7	7.00 "	7	12.00 "	7	7.00 "	7	9.20 "
8	7.00 "	8	12.00 "	8	7.00 "	8	10.25 "
9	7.00 "	9	12.00 "	9	7.00 "	9	11.30 "
10	7.00 "	11	12.30 A.M.	10	7.00 "	11	12.30 A.M.
11	7.00 "	12	1.35 "	11	7.00 "	12	1.35 "
12	7.05 "	13	2.30 "	12	7.05 "	13	2.30 "
13	7.05 "	14	3.20 "	13	7.05 "	14	3.20 "
14	7.05 "	15	4.00 "	14	7.05 "	15	4.00 "
15	7.05 "	16	4.20 "	15	7.05 "	16	4.20 "
16	7.05 "	17	4.20 "	16	7.05 "	17	4.20 "
17	7.10 "	18	4.15 "	17	7.10 "	18	4.15 "
18	7.10 "	19	4.15 "	18	7.10 "	19	4.15 "
19	7.10 "	20	4.15 "	19	7.10 "	20	4.15 "
20	7.10 "	21	4.10 "	20	7.10 "	21	4.10 "
21	7.10 "	22	4.10 "	21	7.10 "	22	4.10 "
22	7.15 "	23	4.10 "	22	7.15 "	23	4.10 "
23	7.15 "	24	4.05 "	23	10.00 "	24	4.05 "
24	7.15 "	25	4.05 "	24	11.00 "	25	4.05 "
25	7.15 "	26	4.05 "	25	11.55 "	26	———
26	7.15 "	26	12.00 M.	26	———	—	———
27	12.40 A.M.	27	4.05 A.M.	27	12.40 A.M.	27	4.05 A.M.
27	7.20 P.M.	27	12.00 M.	28	1.15 "	28	4.00 "
28	1.15 A.M.	28	4.00 A.M.	29	1.45 "	29	4.00 "
28	7.20 P.M.	28	12.00 M.	30	2.10 "	30	4.00 "
29	1.45 A.M.	29	4.00 A.M.				
29	7.20 P.M.	29	12.00 M.				
30	2.10 A.M.	30	4.00 A.M.				
30	7.20 P.M.	30	12.00 M.				

MAY, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	2.30 A.M.	1	4.00 A.M.	1	2.30 A.M.	1	4.00 A.M.
1	7.20 P.M.	1	12.00 M.	2	3.00 "	2	4.00 "
2	7.20 "	2	12.00 "	3	No light.	3	No light.
3	7.25 "	3	12.00 "	4	No light.	4	No light.
4	7.25 "	4	12.00 "	5	No light.	5	No light.
5	7.25 "	5	12.00 "	6	7.25 P.M.	6	9.20 P.M.
6	7 25 "	6	12.00 "	7	7.25 "	7	10.25 "
7	7.25 "	7	12.00 "	8	7.30 "	8	11.30 "
8	7.30 "	8	12.00 "	9	7.30 "	10	12.25 A.M.
9	7.30 "	10	12.25 A.M.	10	7.30 "	11	1.20 "
10	7.30 "	11	1.20 "	11	7.30 "	12	2.00 "
11	7.30 "	12	2.00 "	12	7.30 "	13	2.40 "
12	7.30 "	13	2.40 "	13	7.35 "	14	3.15 "
13	7.35 "	14	3.15 "	14	7.35 "	15	3.45 "
14	7.35 "	15	3.45 "	15	7.35 "	16	3.40 "
15	7.35 "	16	3.40 "	16	7.35 "	17	3.40 "
16	7.35 "	17	3.40 "	17	7.35 "	18	3.40 "
17	7.35 "	18	3.40 "	18	7.40 "	19	3.40 "
18	7.40 "	19	3.40 "	19	7.40 "	20	3.40 "
19	7.40 "	20	3.40 "	20	7.40 "	21	3.40 "
20	7.40 "	21	3.40 "	21	7.40 "	22	3.40 "
21	7.40 "	22	3.40 "	22	7.40 "	23	3.35 "
22	7.40 "	23	3.35 "	23	10.30 "	24	3.35 "
23	7.45 "	24	3.35 "	24	11.15 "	25	3.53 "
24	7.45 "	25	3.35 "	25	11.45 "	26	3.35 "
25	7.45 "	26	3.35 "	26	———	—	———
26	7.45 "	27	3.35 "	27	12.15 A.M.	27	3.35 A.M.
27	7.45 "	27	12.00 M.	28	12.40 "	28	3.35 "
28	12.40 A.M.	28	3.35 A.M.	29	1.00 "	29	3.35 "
28	7.45 P.M.	28	12.00 M.	30	1.25 "	30	3.35 "
29	1.00 A.M.	29	3.35 A.M.	31	1.50 "	31	3.30 "
29	7.45 P.M.	29	12.00 M.				
30	1.25 A.M.	30	3.35 A.M.				
30	7.45 P.M.	30	12.00 M.				
31	7.45 "	31	12.00 "				

JUNE, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	7.50 P.M.	1	12.00 M.	1	No light.	1	No light.
2	7.50 "	2	12.00 "	2	No light.	2	No light.
3	7.50 "	3	12.00 "	3	No light.	3	No light.
4	7.50 "	4	12.00 "	4	No light.	4	No light.
5	7.50 "	5	12.00 "	5	7.50 P.M.	5	10.20 P.M.
6	7.55 "	6	12.00 "	6	7.55 "	6	11.15 "
7	7.55 "	7	12.00 "	7	7.55 "	7	12.00 M.
8	7.55 "	8	12.00 "	8	7.55 "	9	12.45 A.M.
9	7.55 "	10	1.20 A.M.	9	7.55 "	10	1.20 "
10	7.55 "	11	1.50 "	10	7.55 "	11	1.50 "
11	7.55 "	12	2.15 "	11	7.55 "	12	2.15 "
12	7.55 "	13	2.45 "	12	7.55 "	13	2.45 "
13	7.55 "	14	3.15 "	13	7.55 "	14	3.15 "
14	7.55 "	15	3.30 "	14	7.55 "	15	3.30 "
15	7.55 "	16	3.30 "	15	7.55 "	16	3.30 "
16	7.55 "	17	3.30 "	16	7.55 "	17	3.30 "
17	8.00 "	18	3.30 "	17	8.00 "	18	3.30 "
18	8.00 "	19	3.30 "	18	8.00 "	19	3.30 "
19	8.00 "	20	3.30 "	19	8.00 "	20	3.30 "
20	8.00 "	21	3.30 "	20	8.00 "	21	3.30 "
21	8.00 "	22	3.30 "	21	8.00 "	22	3.30 "
22	8.00 "	23	3.30 "	22	10.15 P.M.	23	3.30 "
23	8.00 "	24	3.30 "	23	10.40 "	24	3.30 "
24	8.00 "	25	3.30 "	24	11.05 "	25	3.30 "
25	8.00 "	26	3.30 "	25	11.30 "	26	3.30 "
26	8.00 "	27	3.30 "	26	11.50 "	27	3.30 "
27	8.00 "	28	3.30 "	27	———	—	———
28	8.00 "	29	3.30 "	28	12.15 A.M.	28	3.30 A.M.
29	8.00 "	29	12.00 M.	29	12.40 "	29	3.30 "
30	1.10 A.M.	30	3.30 A.M.	30	1.10 "	30	3.30 "
30	8.00 P.M.	30	12.00 M.				

JULY, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	8.00 P.M.	1	12.00 M.	1	1.45 A.M.	1	3.30 A.M.
2	8.00 "	2	12.00 "	2	No light.	2	No light.
3	8.00 "	3	12.00 "	3	No light.	3	No light.
4	8.00 "	4	12.00 "	4	No light.	4	No light.
5	8.00 "	5	12.00 "	5	8.00 P.M.	5	10.40 P.M.
6	8.00 "	6	12.00 "	6	8.00 "	6	11.20 "
7	8.00 "	7	12.00 "	7	8.00 "	7	11.50 "
8	8.00 "	9	12.20 A.M.	8	8.00 "	9	12.20 A.M.
9	8.00 "	10	12.50 "	9	8.00 "	10	12.50 "
10	8.00 "	11	1.15 "	10	8.00 "	11	1.15 "
11	7.55 "	12	1.45 "	11	7.55 "	12	1.45 "
12	7.55 "	13	2.20 "	12	7.55 "	13	2.20 "
13	7.55 "	14	3.00 "	13	7.55 "	14	3.00 "
14	7.55 "	15	3.40 "	14	7.55 "	15	3.40 "
15	7 55 "	16	3.40 "	15	7.55 "	16	3.40 "
16	7.55 "	17	3.40 "	16	7.55 "	17	3.40 "
17	7.55 "	18	3.45 "	17	7.55 "	18	3.45 "
18	7.55 "	19	3.45 "	18	7.55 "	19	3.45 "
19	7.55 "	20	3.45 "	19	7.55 "	20	3.45 "
20	7.50 "	21	3.45 "	20	7.50 "	21	3.45 "
21	7.50 "	22	3.45 "	21	7.50 "	22	3.45 "
22	7.50 "	23	3.45 "	22	9.30 "	23	3.45 "
23	7.50 "	24	3.50 "	23	9.55 "	24	3.50 "
24	7.50 "	25	3.50 "	24	10.15 "	25	3.50 "
25	7.50 "	26	3.50 "	25	10.40 "	26	3.50 "
26	7.45 "	27	3.50 "	26	11.10 "	27	3.50 "
27	7.45 "	28	3.50 "	27	11.40 "	28	3.50 "
28	7.45 "	29	3.55 "	28	———	—	———
29	7.45 "	29	12.00 M.	29	12.20 A.M.	29	3.55 A.M.
30	7.45 "	30	12.00 "	30	1.10 "	30	3.55 "
31	7.40 "	31	12.00 "	31	2.10 "	31	3.55 "

AUGUST, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	7.40 P.M.	1	12.00 M.	1	No light.	1	No light.
2	7.40 "	2	12.00 "	2	No light.	2	No light.
3	7.40 "	3	12.00 "	3	7.40 P.M.	3	9.50 P.M.
4	7.40 "	4	12.00 "	4	7.40 "	4	10.20 "
5	7.35 "	5	12.00 "	5	7.35 "	5	10.50 "
6	7.35 "	6	12.00 "	6	7.35 "	6	11.20 "
7	7.35 "	7	12.00 "	7	7.35 "	7	11.50 "
8	7.35 "	9	12.20 A.M.	8	7.35 "	9	12.20 A.M.
9	7.35 "	10	1.00 "	9	7.35 "	10	1.00 "
10	7.30 "	11	1.40 "	10	7.30 "	11	1.40 "
11	7.30 "	12	2.30 "	11	7.30 "	12	2.30 "
12	7.30 "	13	3.25 "	12	7.30 "	13	3.25 "
13	7.25 "	14	4.10 "	13	7.25 "	14	4.10 "
14	7.25 "	15	4.10 "	14	7.25 "	15	4.10 "
15	7.25 "	16	4.10 "	15	7.25 "	16	4.10 "
16	7.25 "	17	4.10 "	16	7.25 "	17	4.10 "
17	7.20 "	18	4.10 "	17	7.20 "	18	4.10 "
18	7.20 "	19	4.10 "	18	7.20 "	19	4.10 "
19	7.20 "	20	4.15 "	19	7.20 "	20	4.15 "
20	7.15 "	21	4.15 "	20	7.20 "	21	4.15 "
21	7.15 "	22	4.15 "	21	8.40 "	22	4.15 "
22	7.15 "	23	4.15 "	22	9.10 "	23	4.15 "
23	7.15 "	24	4.15 "	23	9.40 "	24	4.15 "
24	7.10 "	25	4.20 "	24	10.15 "	25	4.20 "
25	7.10 "	26	4.20 "	25	11.00 "	26	4.20 "
26	7.10 "	27	4.20 "	26	11.50 "	27	4.20 "
27	7.10 "	28	4.20 "	27	———	—	———
28	7.05 "	28	12.00 M.	28	12.50 A.M.	28	4.20 A.M.
29	7.05 "	29	12.00 "	29	2.00 "	29	4.20 "
30	7.05 "	30	12.00 "	30	No light.	30	No light.
31	7.00 "	31	12.00 "	31	No light.	31	No light.

SEPTEMBER, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	7.00 P.M.	1	12.00 M.	1	7.00 P.M.	1	8.50 P.M.
2	7.00 "	2	12.00 "	2	7.00 "	2	9.20 "
3	6.55 "	3	12.00 "	3	6.55 "	3	9.50 "
4	6.55 "	4	12.00 "	4	6.55 "	4	10.20 "
5	6.55 "	5	12.00 "	5	6.55 "	5	11.00 "
6	6.50 "	6	12.00 "	6	6.50 "	6	11.40 "
7	6.50 "	8	12.25 A.M.	7	6.50 "	8	12.25 "
8	6.50 "	9	1.20 "	8	6.50 "	9	1.20 "
9	6.45 "	10	2.20 "	9	6.45 "	10	2.20 "
10	6.45 "	11	3.20 "	10	6.45 "	11	3.20 "
11	6.45 "	12	4.20 "	11	6.45 "	12	4.20 "
12	6.40 "	13	4.35 "	12	6.40 "	13	4.35 "
13	6.40 "	14	4.35 "	13	6.40 "	14	4.35 "
14	6.40 "	15	4.35 "	14	6.40 "	15	4.35 "
15	6.35 "	16	4.40 "	15	6.35 "	16	4.40 "
16	6.35 "	17	4.40 "	16	6.35 "	17	4.40 "
17	6.35 "	18	4.40 "	17	6.35 "	18	4.40 "
18	6.30 "	19	4.40 "	18	6.30 "	19	4.40 "
19	6.30 "	20	4.45 "	19	6.30 "	20	4.45 "
20	6.30 "	21	4.45 "	20	8.10 "	21	4.45 "
21	6.25 "	22	4.45 "	21	8.50 "	22	4.45 "
22	6.25 "	23	4.45 "	22	9.40 "	23	4.45 "
23	6.25 "	24	4.45 "	23	10.35 "	24	4.45 "
24	6.20 "	25	4.50 "	24	11.40 "	25	4.50 "
25	6.20 "	26	4.50 "	25	———	—	———
26	6.20 "	26	12.00 M.	26	12.50 A.M.	26	4.50 A.M.
27	6.15 "	27	12.00 "	27	2.10 "	27	4.50 "
28	6.15 "	28	12.00 "	28	3.25 "	28	4.50 "
29	6.15 "	29	12.00 "	29	No light.	29	No light.
30	6.10 "	30	12.00 "	30	No light.	30	No light.

OCTOBER, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.

NOVEMBER, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.

DECEMBER, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.

OCTOBER, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	6.10 P.M.	1	12.00 M.	1	6.10 P.M.	1	8.15 P.M.
2	6.10 "	2	12.00 "	2	6.10 "	2	8.50 "
3	6.05 "	3	12.00 "	3	6.05 "	3	9.30 "
4	6.05 "	4	12.00 "	4	6.05 "	4	10.20 "
5	6.05 "	5	12.00 "	5	6.05 "	5	11.15 "
6	6.05 "	7	12.10 A.M.	6	6.05 "	7	12.10 A.M.
7	6.00 "	8	1.15 "	7	6.00 "	8	1.15 "
8	6.00 "	9	2.15 "	8	6.00 "	9	2.15 "
9	6.00 "	10	3.15 "	9	6.00 "	10	3.15 "
10	5.55 "	11	4.15 "	10	5.55 "	11	4.15 "
11	5.55 "	12	5.05 "	11	5.55 "	12	5.05 "
12	5.55 "	13	5.05 "	12	5.55 "	13	5.05 "
13	5.50 "	14	5.05 "	13	5.50 "	14	5.05 "
14	5.50 "	15	5.05 "	14	5.50 "	15	5.05 "
15	5.50 "	16	5.05 "	15	5.50 "	16	5.10 "
16	5.45 "	17	5.10 "	16	5.45 "	17	5.10 "
17	5.45 "	18	5.10 "	17	5.45 "	18	5.10 "
18	5.45 "	19	5.10 "	18	5.45 "	19	5.10 "
19	5.45 "	20	5.10 "	19	7.30 "	20	5.10 "
20	5.40 "	21	5.15 "	20	8.25 "	21	5.15 "
21	5.40 "	22	5.15 "	21	9.25 "	22	5.15 "
22	5.40 "	23	5.15 "	22	10.30 "	23	5.15 "
23	5.35 "	24	5.15 "	23	11.45 "	24	5.15 "
24	5.35 "	24	12.00 M.	24	—	—	—
25	5.35 "	25	12.00 "	25	1.00 A.M.	25	5.20 A.M.
26	5.35 "	26	12.00 "	26	2.15 "	26	5.20 "
27	5.30 "	27	12.00 "	27	3.30 "	27	5.30 "
28	5.30 "	28	12.00 "	28	No light.	28	No light.
29	5.30 "	29	12.00 "	29	No light.	29	No light.
30	5.30 "	30	12.00 "	30	No light.	30	No light.
31	5.25 "	31	12.00 "	31	6.05 P.M.	31	8.10 P.M.

NOVEMBER, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	5.25 P.M.	1	12.00 M.	1	5.25 P.M.	1	9.00 P.M.
2	5.25 "	2	12.00 "	2	5.25 "	2	10.00 "
3	5.25 "	3	12.00 "	3	5.25 "	3	11.00 "
4	5.20 "	4	12.00 "	4	5.20 "	5	12.05 A.M.
5	5.20 "	6	1.10 A.M.	5	5.20 "	6	1.10 "
6	5.20 "	7	2.10 "	6	5.20 "	7	2.10 "
7	5.20 "	8	3.10 "	7	5.20 "	8	3.10 "
8	5.20 "	9	4.10 "	8	5.20 "	9	4.10 "
9	5.15 "	10	5.10 "	9	5.15 "	10	5.10 "
10	5.15 "	11	5.40 "	10	5.15 "	11	5.40 "
11	5.15 "	12	5.40 "	11	5.15 "	12	5.40 "
12	5.15 "	13	5.40 "	12	5.15 "	13	5.40 "
13	5.15 "	14	5.40 "	13	5.15 "	14	5.40 "
14	5.10 "	15	5.40 "	14	5.10 "	15	5.40 "
15	5.10 "	16	5.45 "	15	5.10 "	16	5.45 "
16	5.10 "	17	5.45 "	16	5.10 "	17	5.45 "
17	5.10 "	18	5.45 "	17	5.10 "	18	5.45 "
18	5.10 "	19	5.45 "	18	8.20 "	19	5.45 "
19	5.10 "	20	5.50 "	19	9.30 "	20	5.50 "
20	5.10 "	21	5.50 "	20	10.40 "	21	5.50 "
21	5.05 "	22	5.50 "	21	11.45 "	22	5.50 "
22	5.05 "	22	12.00 M.	22	—	—	—
23	1.10 A.M.	23	5.50 A.M.	23	1.10 A.M.	23	5.50 A.M.
23	5.05 P.M.	23	12.00 M.	24	2.20 "	24	5.55 "
24	5.05 "	24	12.00 "	25	3.40 "	25	5.55 "
25	5.05 "	25	12.00 "	26	No light.	26	No light.
26	5.05 "	26	12.00 "	27	No light.	27	No light.
27	5.05 "	27	12.00 "	28	No light.	28	No light.
28	5.05 "	28	12.00 "	29	5.05 P.M.	29	7.40 P.M.
29	5.05 "	29	12.00 "	30	5.05 "	30	8.45 "
30	5.05 "	30	12.00 "				

DECEMBER, 1909

Table No. 1. Frund's System.				Table No. 2. Standard System.			
Date.	Light.	Date.	Exting.	Date.	Light.	Date.	Exting.
1	5.05 P.M.	1	12.00 M.	1	5.05 P.M.	1	9.50 P.M.
2	5.05 "	2	12.00 "	2	5.05 "	2	11.00 "
3	5.05 "	3	12.00 "	3	5.05 "	3	12.00 M.
4	5.05 "	5	1.00 A.M.	4	5.05 "	5	1.00 A.M.
5	5.05 "	6	2.00 "	5	5.05 "	6	2.00 "
6	5.05 "	7	3.00 "	6	5.05 "	7	3.00 "
7	5.05 "	8	3.55 "	7	5.05 "	8	3.55 "
8	5.05 "	9	4.55 "	8	5.05 "	9	4.55 "
9	5.05 "	10	5.55 "	9	5.05 "	10	5.55 "
10	5.05 "	11	6.10 "	10	5.05 "	11	6.10 "
11	5.05 "	12	6.10 "	11	5.05 "	12	6.10 "
12	5.05 "	13	6.10 "	12	5.05 "	13	6.10 "
13	5.05 "	14	6.10 "	13	5.05 "	14	6.10 "
14	5.05 "	15	6.15 "	14	5.05 "	15	6.15 "
15	5.05 "	16	6.15 "	15	5.05 "	16	6.15 "
16	5.05 "	17	6.15 "	16	5.05 "	17	6.15 "
17	5.05 "	18	6.15 "	17	8.30 "	18	6.15 "
18	5.05 "	19	6.15 "	18	9.45 "	19	6.15 "
19	5.05 "	20	6.15 "	19	10.55 "	20	6.15 "
20	5.05 "	21	6.15 "	20	—	—	—
21	5.05 "	21	12.00 M.	21	12.05 A.M.	21	6.15 "
22	1.20 A.M.	22	6.15 A.M.	22	1.20 "	22	6.15 "
22	5.05 P.M.	22	12.00 M.	23	2.30 "	23	6.15 "
23	5.05 "	23	12.00 "	24	3.50 "	24	6.20 "
24	5.05 "	24	12.00 "	25	No light.	25	No light.
25	5.10 P.M.	25	12.00 "	26	No light.	26	No light.
26	5.10 "	26	12.00 "	27	No light.	27	No light.
27	5.10 "	27	12.00 "	28	5.10 P.M.	28	7.30 P.M.
28	5.10 "	28	12.00 "	29	5.10 "	29	8.40 "
29	5.10 "	29	12.00 "	30	5.10 "	30	9.40 "
30	5.10 "	30	12.00 "	31	5.10 "	31	10.50 "
31	5.10 "	31	12.00 "				

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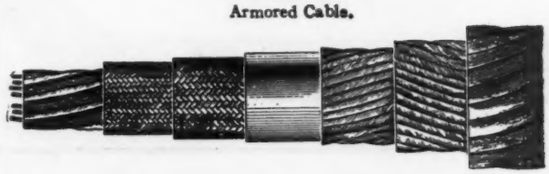

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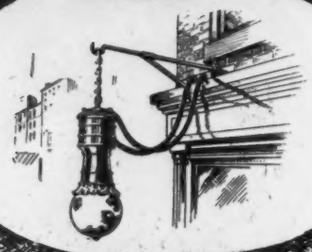

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FOR ALL PURPOSES

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PERTH AMBOY, N. J.

Railway Signal Engineers

Attention is called to the following extract from an analysis made October 21st, 1908, by the well-known chemist and rubber expert, J. P. Millwood, 246 Willoughby St., Brooklyn, N. Y., of

Habirshaw Railway Signal Compound

Extractive by Acetone - -	(Organic Extract)	1.81%
	(Free Sulphur)	0.36%
Rubber Gum - - - - - - - - - -		33.86%
Mineral matter, combined sulphur, etc. - - - -		63.97%
		100.00%

Mr. Millwood states that in the percentage of rubber gum there is included a very small, undetermined amount of carbonaceous matter, and that "there is no evidence to indicate it (the compound) is not made from pure Para rubber."

It will be seen that the above is much better than the chemical tests required by Specifications of The Railway Signal Engineer's Association. The physical and electrical tests are also in excess of requirements.

We would be pleased to have you verify these statements by sending for a sample coil sufficient to make all tests.

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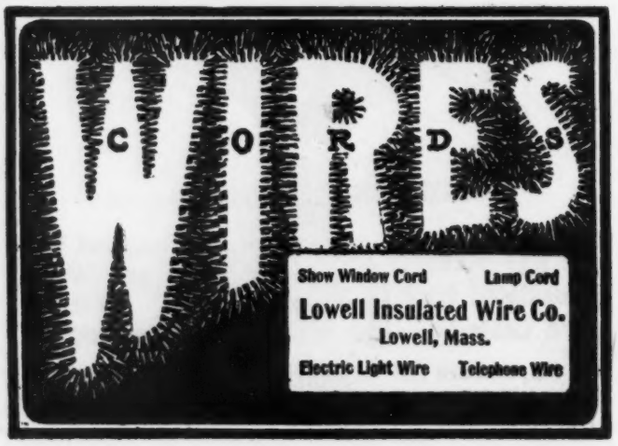

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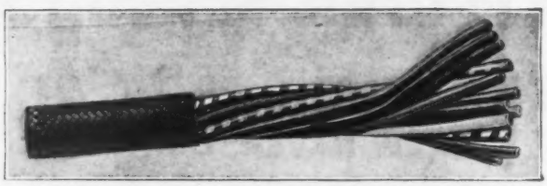

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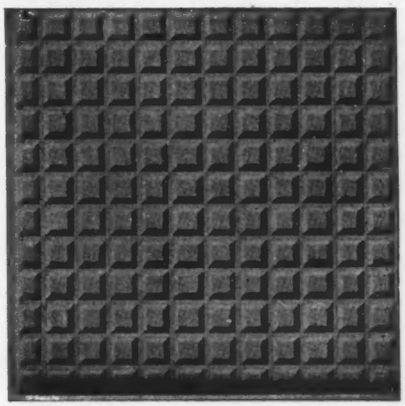

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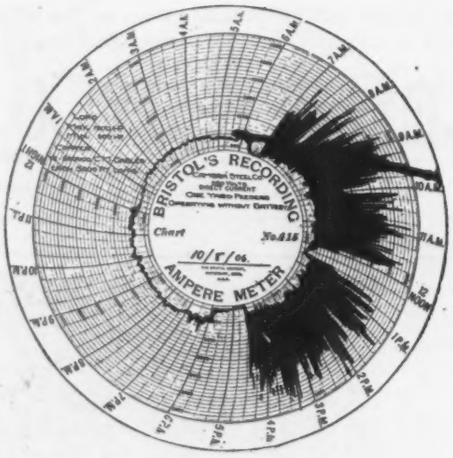

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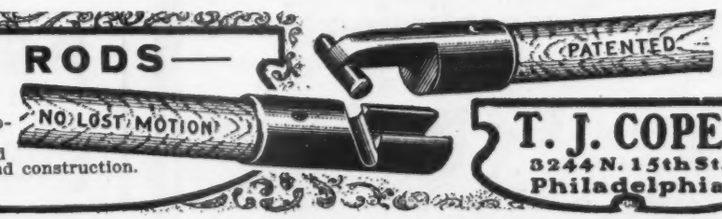

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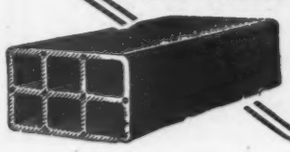

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will do what no other compound will do, because it works on a different principle. Its action is mechanical and not chemical. Iron, under heat, attracts MAGIC like a magnet does steel. It is drawn through the cracks in scale and works its way between the scale and the iron, coating it in much the same manner as cylinder oil coats the surface of a cylinder This action loosens the scale and it drops off. The scale sediment can then be blown off or washed out.

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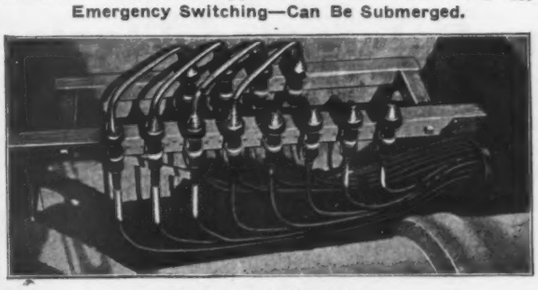

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Primary: 1100-2200 Volts. Secondary: 110-220 and 220-440 Volts.

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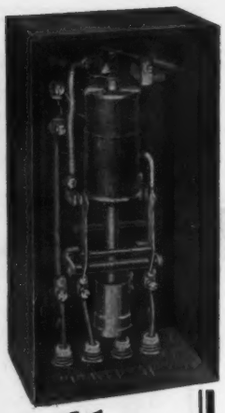

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Type K Single-Phase Meter.

The Type K Meter

stands for all that is good in an integrating wattmeter. Thousands of users stand for the Type K Meter because its good shows in service. The design is right—it is proved by years of good service, but it is better to-day than ever because we improve the details to meet new conditions.

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True in more ways than one.

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0-6 Volts, 0-30 amperes $5.00
Ammeter only --- 0-30 Amperes $3.50

The ampere side is used for testing dry and wet batteries, the voltage side for storage batteries.

Accurate, Durable, Low in Price

SEND FOR CIRCULAR No. 20.

CONNECTICUT TELEPHONE & ELEC. CO.
MERIDEN, CONN., U. S. A.

KENT POCKET METERS

THE STANDARD BATTERY TESTERS

Hand graduated—accuracy guaranteed.
Dead beat—quick reading.
Unbreakable celluloid window.

Combination Volt-Ammeters
(To read amperes, press button)
0-6 volts, 0-30 amperes, $6.
0-10 volts, 0-30 amperes, $7.
Voltmeters, 0-9 volts, $4; 0-20 volts, $5.
Ammeter, 0-30 amperes, $4.

ATWATER KENT MANUFACTURING WORKS
34 North Sixth Street, Philadelphia, Pa.

When purchasing a battery tester specify "Robert" and be assured of an accurate and guaranteed instrument.

SEND FOR CATALOG

Pocket Volt-Ammeters	$6.00
" Volt-Meters	4.00
" Ammeters	4.00

Including Leather Case.

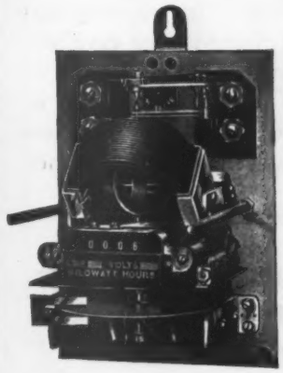
Robert Instrument Co., 46 Shelby St., Detroit, Mich.

TEST YOUR BATTERIES WITH AN

ELDREDGE BATTERY VOLTMETER

For Testing Primary and Storage Batteries, 0 to 3 volts, 0 to 6 volts. 0 to 10 volts.

ELDREDGE ELECTRIC MFG. CO.
Springfield, Mass U. S. A.



Columbia Meters

Every one is accurate when you get it and stays so

Write for prices

COLUMBIA METER CO.
Indianapolis, Indiana.

THE
NEW METER

just developed by this company surpasses anything that has yet been accomplished in the meter art. Experts pronounce it as fulfilling the most exacting requirements of modern central station practice.

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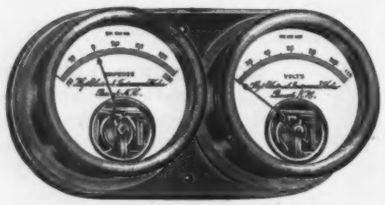
Duncan Electric Manufacturing Co.
Lafayette, Ind.

The Hoyt I. U. Voltammeter
Made on the Interchangeable Unit Plan.



This arrangement combines two Type C 35 instruments mounted on a single base, and are independent of each other so that either instrument may, in case of necessity, be removed without disturbing the other. Instruments may also be rotated to permit of using them vertically (one above the other) or horizontally (side by side). They have been in commercial use on Electric Vehicles for the past year, and have given excellent satisfaction. Size 8½ x 4½ inches.

Ask for Bulletin E. W.

Hoyt Electrical Instrument Works
PENACOOK, NEW HAMPSHIRE.
N. E. Office, 161 Summer St., Boston.

TACHOMETERS

Our No. 4 Hand Tachometers will register speeds in either direction from 30 to 4,000 revolutions per minute. Only one spindle required for all four speed ranges. The change from one speed range to another can be effected while the Tachometer is in use, by pushing the thumb slide on the face up or down.

Send for Catalogue.

Schuchardt & Schutte
136 Liberty Street, New York

QUEEN ELECTRICAL TESTING INSTRUMENTS
For All Purposes
QUEEN & CO., Inc.
PHILADELPHIA

The Universal d'Arsonval Galvanometer
Convenient, Sensitive, Portable
Can be quickly changed from Dead Beat to Ballistic. An inexpensive, high-grade instrument.
FREDK. PEARCE CO., 18 & 20 ROSE ST., New York City

Say well is good, Do well is better

Tho so many good things can be said about really good electrical instruments, we've gone further and have done well in getting out this new

Keystone Instrument

It's our new Type H, horizontal edgewise type. It takes less room on a board than any other of similar type but the scale is larger and more easily read at a distance. Only two holes to drill for mounting voltmeters and ammeters, four for wattmeters. Made for A. C., D. C. or A. C. and D. C. and right up to the top notch of Keystone Quality.

Keystone Electrical Instrument Co.

9th Street and Montgomery Ave., Philadelphia

New York Hudson Term. Bldg. *Boston* 170 Summer St. *Pittsburgh* Westinghouse Bldg.

Siemens & Halske. &

Hudson Terminal Bldg.
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NEW!

THE CENTRAL STATION STANDARDS:

SIEMENS
Technical Potentiometer
for checking switchboard and portable instruments.

SIEMENS
Recording Volt, Am, and Watt meters

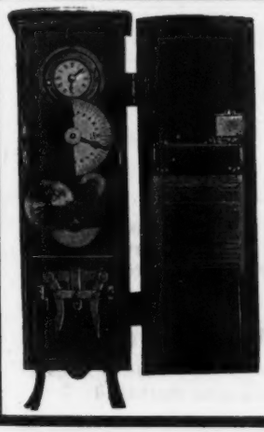
SIEMENS
Portable Photometer
for incandescent lamps.

NEW!

SIEMENS
Complete Meter Testing Outfit

For testing and calibrating meters and for making other tests about the plant.

EVERY PROMINENT ELECTRICAL LABORATORY IS A REFERENCE FOR SIEMENS INSTRUMENTS



The Anderson Time Switch

will open or close electric circuits at any time of day or night. It is simple, rugged and substantial, and never fails to do its work.

Every detail of its mechanism and operation is interestingly described in our bulletin, mailed at your request.

Albert & J. M. Anderson Mfg. Co., Boston, Mass., U. S. A.

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The First Step Toward Economy
is the use of **The Ideal Recorder**
"The Instrument that never forgets"
Central Laboratory Supply Co.
Lafayette, Ind.

Accurate, Compact, Inexpensive
VOLTMETERS, AMMETERS
and VOLT-AMMETERS
Send for complete catalog.
LOUIS M. PIGNOLET
78 Cortlandt Street **New York**

"American" D. C. Voltmeters and Ammeters

Siemens & Halske Precision A. C. Voltmeters, Ammeters and Wattmeters; Frequency Meters; Kelvin Electrostatic Voltmeters; Pocket Voltmeters, Ammeters and Combined Volt and Ammeters; Hot-wire Voltmeters and Ammeters; Recording Voltmeters. Ammeters and Wattmeters; Tachometers; Wolff Potentiometers, Bridges, Resistances, etc., etc.

We make a specialty of the best instruments that are of interest to electrical men, for both commercial and research work.

Write for Bulletin 660, just published. It tells about the various Bulletins and Catalogs we issue

JAMES G. BIDDLE, 1114 Chestnut St., Philadelphia

L. & N.
Decade Portable Testing Sets

THE LEEDS & NORTHRUP CO.

4901 Stenton Avenue, Philadelphia

Monadnock Block, Chicago

The L. & N. Portable Testing Sets are convenient instruments for the accurate measurement of resistance and location of faults.

We make a complete line of Cable Testing Apparatus, Standardizing Apparatus for Calibrating Ammeters and Voltmeters, both D. C. and A. C., Galvanometers, Resistance Boxes and Standards, Condensers and other Electrical Measuring Apparatus. Catalogues will be sent on request.

Electrical Measuring Instruments

2

Roller-Smith Company

Bethlehem, Pa.

MAKERS OF ELECTRICAL APPARATUS

For information regarding

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Automatic Controllers

Direct or Alternating Current
for
FREIGHT OR PASSENGER ELEVATORS
MECHANICAL, CARSWITCH AND AUTOMATIC

SELF STARTERS FOR PUMP AND AIR COMPRESSOR MOTORS, PRINTING PRESS AND ALL CLASSES OF REMOTE CONTROL

INC. 1888—20 YEARS' EXPERIENCE

AUTOMATIC SWITCH CO.

131 Liberty Street **New York**

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OIL AND POLE TOP SWITCHES

Solid, Indestructible, Self-contained Oil Switches for Voltages Over 20,000, and Hand or Automatic Control.

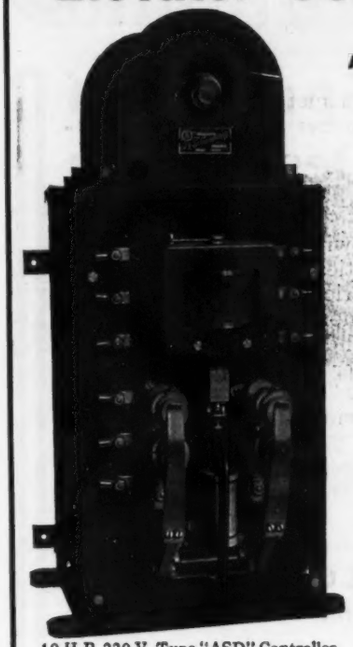
Pole Top Switches that unfailingly open all phases at once. Controlled from the ground.

SEND FOR CIRCULARS.

PACIFIC ELECTRIC AND MANUFACTURING CO.

604 MISSION STREET, SAN FRANCISCO, CAL.

"SCHUREMAN"
Elevator Controllers



10 H.P. 220 V. Type "ASD" Controller for Slip Ring Type Motor.

FOR
ALTERNATING CURRENT MOTORS

TYPE "ASD" FOR HAND CABLE CONTROL

QUICK-BREAK, ENCLOSED REVERSING SWITCH.
SOLENOID-OPERATED RHEOSTAT, PROVIDING NO-VOLTAGE RELEASE.
CARBON & COPPER "BUTT-END" CONTACTS. NO SLIDING CONTACTS.
NOISELESS SOLENOID.
VACUUM DASHPOT

WE SPECIALIZE IN ELEVATOR CONTROLLERS AND SELF-STARTERS FOR ALL KINDS OF SERVICE, A. C. AND D. C.

WRITE US AND GET THE BENEFIT OF OUR 14 YEARS' EXPERIENCE.

J. L. SCHUREMAN CO.
70-86 West Jackson Boulevard, Chicago
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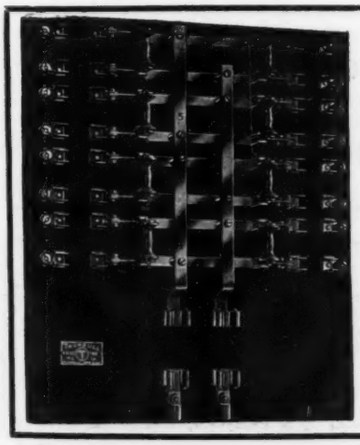
We Make Oil Switches for Every Condition of A. C. Service

We are specialists in this line, and if you cannot find what you require among the standard switches listed in our bulletins, if you will advise us of your conditions, we will gladly submit a design suitable for your work. Write to us when you are needing anything in the oil switch line.

HARTMAN CIRCUIT BREAKER CO.
Mansfield, Ohio.



Trumbull Panel Boards

Write for Catalog.

The Trumbull Electric Mfg. Co.
Plainville, Conn.
NEW YORK:
136 Liberty St.
BOSTON:
65-67 Oliver St.

Our price is seldom the lowest. We take it for granted when you ask us for a price that you want the best or you would not come to us.

There are manufacturers larger than ourselves, a hundred times, who make circuit breakers just as they make a thousand other things; who take no personal interest in what they do; whose sole idea is to give as little as possible either of brains or material for a given sum; with whom circuit breakers are a side line and a troublesome one at that.

We devote practically our entire time to the one thing which has made our reputation —the I. T. E. CIRCUIT BREAKER—the standard to which all others are compared.

THE CUTTER CO., Philadelphia

AN AUTOMATIC STARTER OF PROVEN VALUE—SUNDH

No Sliding Contacts

Small Space

Its Value Has Been Demonstrated

Better Write Us

Sundh Electric Co.

115 Cedar Street " " NEW YORK

Representative in Great Britain, Electric Control, Limited, Glasgow

Small Springs of Every Description

are a specialty with us. Our manufacturing facilities are of the best, and our experience in this line extends over more than fifty years. If you will send drawings and state conditions under which springs are to work, we will quote prices on springs that will fully meet your requirements.

Send us your specifications on special screw machine product up to $\frac{1}{8}$ inch round.

The Wallace Barnes Co.

Bristol, Conn.

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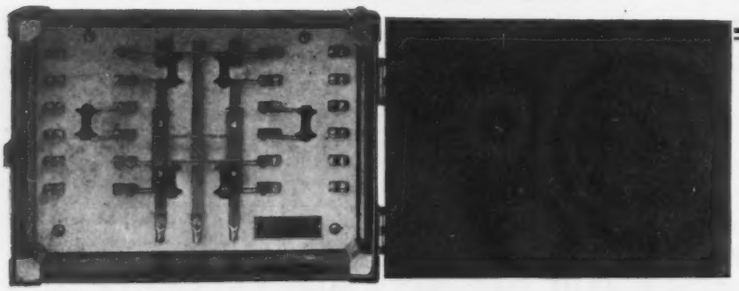

You ought to see a

KRANTZ

Enameled Steel Cabinet

Sheet steel with corner braces—built in our shop every bit. One piece door. Hinges rivet on. Heavy outside catch and lock. Heavier than need be—but that's your advantage. Price is no higher. See Bulletin 20—all about panel boards and accessories.

H. KRANTZ MFG. CO. 160-166 Seventh St. 117-123 Eighth St. **Brooklyn, N. Y.**

Otis & Squires, San Francisco Southern Electric Co., Baltimore Doubleday-Hill Electric Co., Pittsburg Stuart-Howland Co., Boston
Cataract Electric Supply Co., Buffalo F. R. Jenkins, Chicago Electrical Dealers Co., Indianapolis
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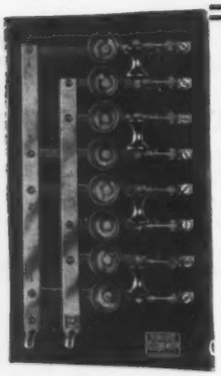


Panel Boards

form a large part of our product. We give them every bit as much attention as we give our Knife Switches and Switchboards.

If you have used them, you know what that means.

If you haven't used them you owe it to yourself to find out about them.

Write for our new illustrated catalogue.

Worcester Electric Mfg. Co. WORCESTER MASS., U. S. A.

THE CONTROL SYSTEMS OF

McLauthlin Electric Dumb Waiters

MEET ANY USUAL REQUIREMENT. SPECIAL REQUIREMENTS EASILY FULFILLED.

GEO. T. McLAUTHLIN CO.

120 Fulton Street Boston

OIL SWITCHES & CIRCUIT BREAKERS

15,000 TO 100,000 VOLTS
HAND OR ELECTRICALLY OPERATED
AUTOMATIC OVERLOAD RELEASE
SELF CONTAINED OR CONCRETE CELL TYPE

KELMAN ELECTRIC & MFG. CO.

1000 N. Main St., Los Angeles, Cal. 194 Lefferts Place, Brooklyn, N. Y. Telephone—Prospect 6355

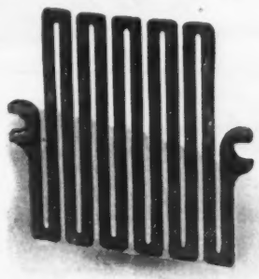
CUTLER-HAMMER

THERE is probably no class of service in which electrical apparatus is subjected to harder usage than in a steel mill. The making of steel is no child's play, but work calling for rugged men and rugged machines. The weakling goes to the wall, and goes quickly, for in this industry the law of the survival of the fittest works 24 hours a day, 365 days in the year. There is no let-up—no chance for tinkering with apparatus. A delay of an hour may mean the loss of thousands of dollars. Hence the demand of the steel mill is for machines that will "stand the racket."

Small Crane Controller, 1 to 5 H. P.

It was with a full knowledge of the conditions to be met that we designed the line of crane controllers described and illustrated in this advertisement Our Pittsburg office, located in the heart of the world's greatest steel-producing territory, is in close touch with the requirements of the steel mills, and Cutler-Hammer crane controllers are built to meet those requirements. They are of exceptionally rugged construction and all parts subject to wear are made renewable and easy of access. They are guaranteed to operate satisfactorily under the most trying conditions and their fitness for this class of work is attested by the fact that they are rapidly displacing all other types of crane controllers, not only in steel mills and foundries, but in shipyards, docks, mines, quarries and other places where the ability of electrical apparatus to stand up under heavy overloads and rough handling is of the first importance.

Some of the advantages of these controllers may be briefly summarized as follows: All contact segments are made of hard drawn copper and are of unusual size and thickness. They are machine made—insuring uniformity. They are secured to the slate by screws, the heads of which are countersunk, enabling roughened contacts to be smoothed with a file without injury to the screw head. Any segment may be readily removed from the front of the controller without disturbing any internal connection



Resistance Grid used in Cutler-Hammer Crane Controllers

Crane Controllers that will "stand the racket"

No "reversing contacts" are used. We have succeeded in eliminating these by devising a method of connection that enables us to reverse the armature of the motor without employing any contact segments other than those required for the commutation of resistance. Of these no fewer than 16 steps are provided in each direction, giving gradual speed changes and practically eliminating sparking between contacts.

Large Crane Controller, 7½ to 100 H. P.

The contact segments are divided into four groups, this division serving to reduce the potential across each set of segments to one-fourth of what it would be if the contacts were arranged into a single group—the form of construction commonly found in controllers of other makes.

Operating levers are mad einterchangeable and a plurality of contact fingers are provided so that damage to one or two fingers will not put the controller out of commission, as sometimes happens with apparatus in which a single finger, or pair of fingers, are depended upon to carry heavy currents.

Each controller is equipped with a powerful blow-out magnet, which is operative on all contacts. Careful attention has been given to the matter of insulation, and large, easily handled pieces have been used throughout. There are no small insulating parts requiring delicate adjustment.

Moisture-proof resistance units are used in the smaller sizes of these crane controllers and cast iron grid resistance in the larger sizes. The resistance units are separately removable and the grids are so assembled that they can be easily taken out of the frame in banks, or any single grid can be removed from the bank of grids without disturbing the others.

Rope Operated Crane Controller.

The accompanying illustrations show some of the forms in which these crane controllers are made. Type A, the smallest size, can be furnished in capacities of from 1 to 5 H.P. A variation of this type is shown in the cut illustrating "Rope Operated Crane Controller," which is designed to be operated from the ground by means of ropes. Types B, C, and D are very similar to one another in construction, the difference between these three types being principally one of capacity. Type D—the largest standard size made—can be furnished up to 100 H.P. at 500 volts, and controllers of greater capacity than this can be furnished to order.

Standard crane controllers are designed for intermittent duty on direct current circuits, but we are also prepared to furnish special controllers for continuous service—slow speed controllers for raising flasks in foundries, and similar duty—and crane controllers designed for use on alternating current circuits.

Our illustrated booklet on crane controllers is free on request to those interested in this subject.

Crane Cab equipped with Cutler-Hammer Control

THE CUTLER-HAMMER MANUFACTURING COMPANY - MILWAUKEE

NEW YORK OFFICE: Hudson Terminal (50 Church Street) CHICAGO: Monadnock Block BOSTON: 176 Federal St.
PITTSBURG: Farmers' Bank Bldg. PACIFIC COAST AGENTS: Otis & Squires, 111 New Montgomery St., San Francisco

TYPE E-1
Size 1 to 5 Horsepower, 220 volts

Price, $6.00

Liberal Quantity Discounts

We Make All Sizes

Allen-Bradley Motor Starters

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A Merry Christmas

To the electrical engineer who uses them.

"They Cure All Motor-Starter Troubles"

Of course you don't know *how* they do it; but if you will write to us we will tell you.

We also will tell you what some large users say.

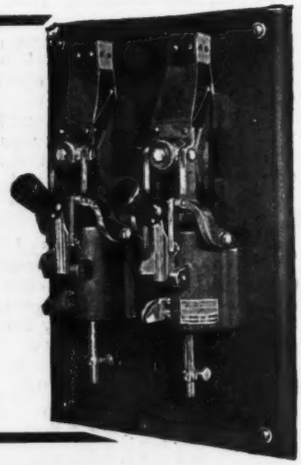
We will send ALLEN-BRADLEY MOTOR STARTERS *on trial*, to any point in the United States. We will pay the freight *both ways*, if returned.

AMERICAN ELECTRIC FUSE CO.

Muskegon, Michigan

We build nothing in the circuit breaker line which is not equipped with a coil to every pole. Other manufacturers will build this kind if you ask them to, but we are the only people who add the interlocking feature, which is the last touch that makes perfection.

Why not specify CONDIT and get the right circuit breaker always?



CONDIT ELECTRICAL MFG. CO.

BOSTON, MASS., U. S. A.

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Montreal, Canada, 814 Notre Dame St., West.
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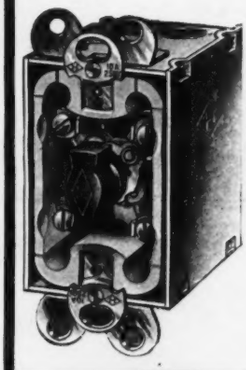
Before you need a switchboard

take the time to see what various manufacturers have to offer. We invite comparison of our switchboards, panel boards, steel cabinets, cut-out cabinets, etc., with those offered anywhere else. Just say you want us to prove our claims to superiority —now while you have time.

Eaton Electric Mfg. Co.

144 East Erie Street, Chicago

If you miss the mark you'll miss the quality



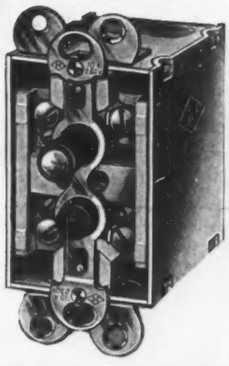
Good to look for Better to find

"DIAMOND H" Switches and Receptacles

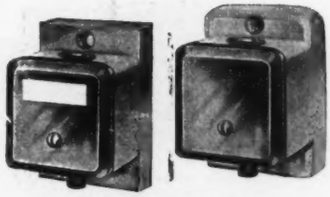
The kind good dealers sell and good buyers demand.

HART MFG. COMPANY
HARTFORD, CONN.

New York Boston Chicago Denver San Francisco
Toronto, Ont. London, Eng.



CUTLER-HAMMER PUSH-BUTTON SPECIALTIES



No. 7102 *No. 7103*
Push-Button Surface Switches
(With label holder) *(Without label holder)*

Here are four good sellers. Let us send you our booklet describing the full line of Cutler-Hammer Push-Button Pendent Switches, Surface Switches and Sockets. Made of porcelain—plain, white and colored.

THE CUTLER-HAMMER MFG. CO.
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NEW YORK: Hudson Terminal, 50 Church St.
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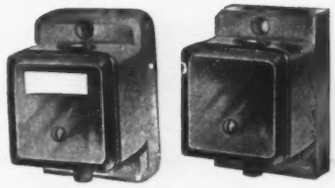
BOSTON: 176 Federal St



No. 7100 *No. 7101*
Push Button Molding Switches 3
(With label holder) *(Without label holder)*

NATIONAL ELECTRICAL CODE STANDARD

2

Tree Insulators

Prevent leakage, short circuits and tree grounds

Made of Malleable Iron with double petticoat insulator and porcelain bushing. Always in upright position regardless of slant of tree.

Style A takes wire up to No. 00
Style B takes wires up to and including No. 0000

High Tension Electrical Specialty Co.
NEWTON, MASS.

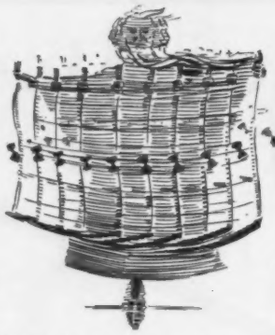
PRATT GALVANIZED CONDUIT OUTLET BOXES AND COVERS

Easy Clean Knock-Outs
Labor-Saving Covers
Perfect in Every Detail

Approved by the Underwriters
Perfect Ground
Casting Does Not Chip Off

Send for Catalogue

The Pratt Chuck Co.
Frankfort, N. Y.



The Whirligig of Time

goes 'round and 'round. Here we are again, at the season when all the world makes good resolutions for the New Year. If **you** resolve to do all your conduit work with

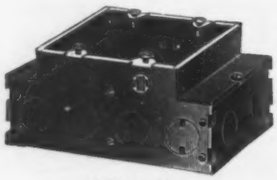
Bossert Drawn Steel Boxes

you will do yourself a good turn. You can meet your competitors' figures, and also turn a good profit on your work, because Bossert Boxes save time—and make money. The sample will show you.

Write for it.

Bossert Electric Construction Co.
Utica, N. Y.

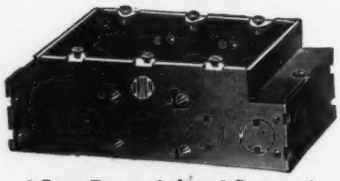
"UNION" SECTIONAL CONDUIT BOXES



2-Gang Box
Patented April 2, 1907

No. 160.—For Push Button, Rotary Rectangular Base Switches and Plug Receptacles

MADE FROM 14-GAUGE STAMPED STEEL
SUPERIOR TO CAST IRON BOXES



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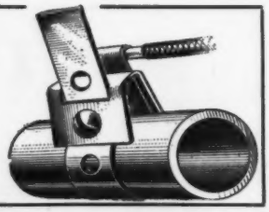

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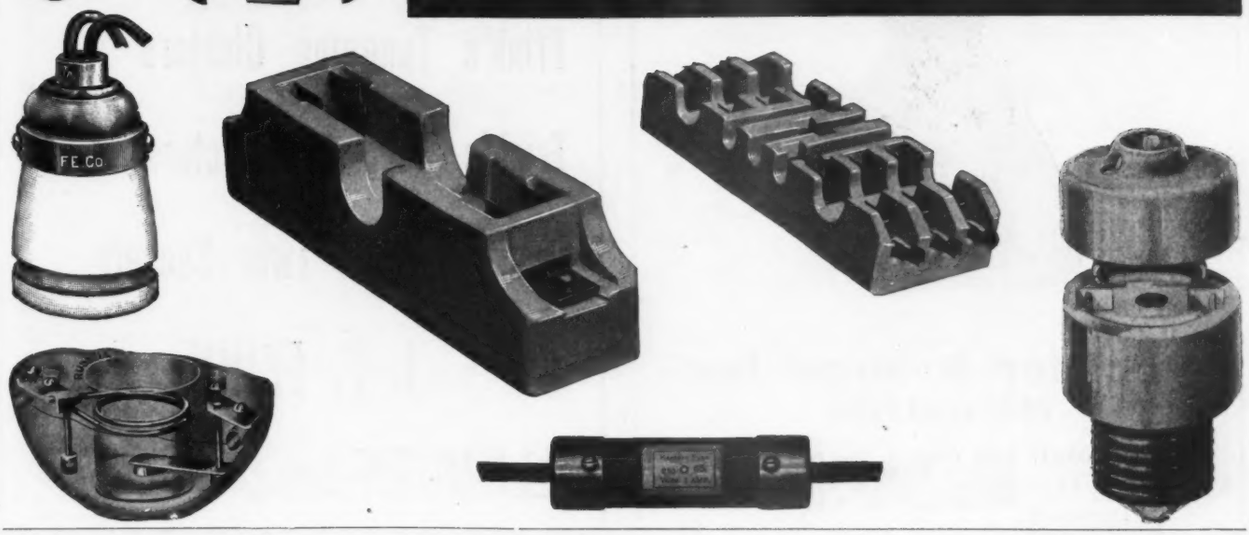

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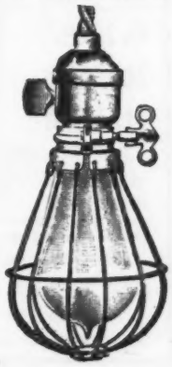

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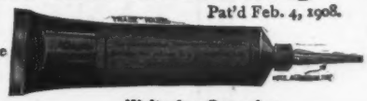

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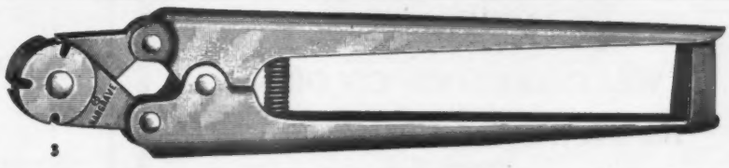

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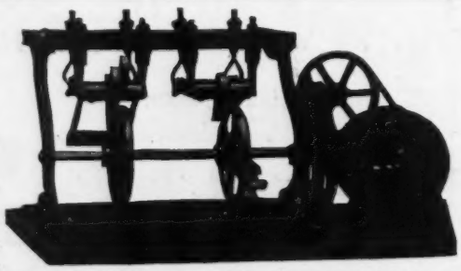

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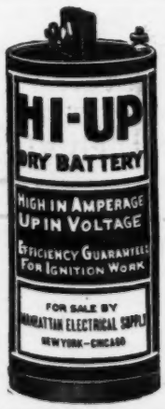

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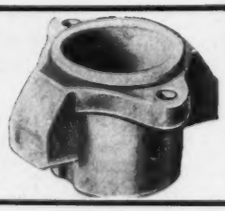

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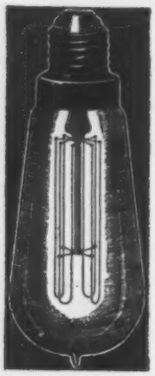

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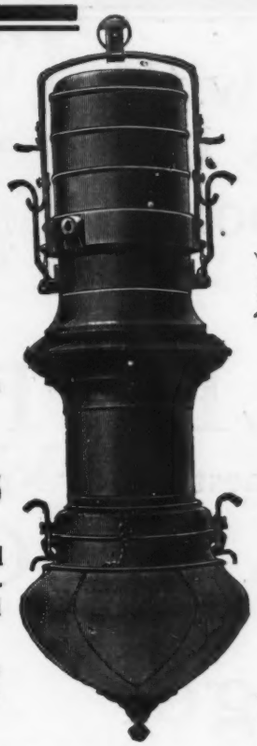

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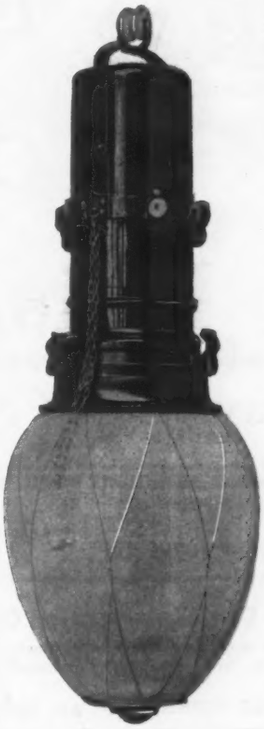

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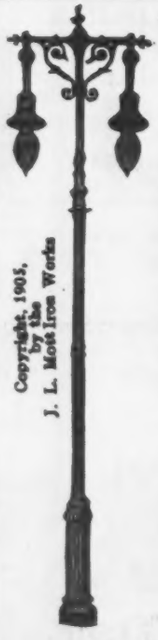

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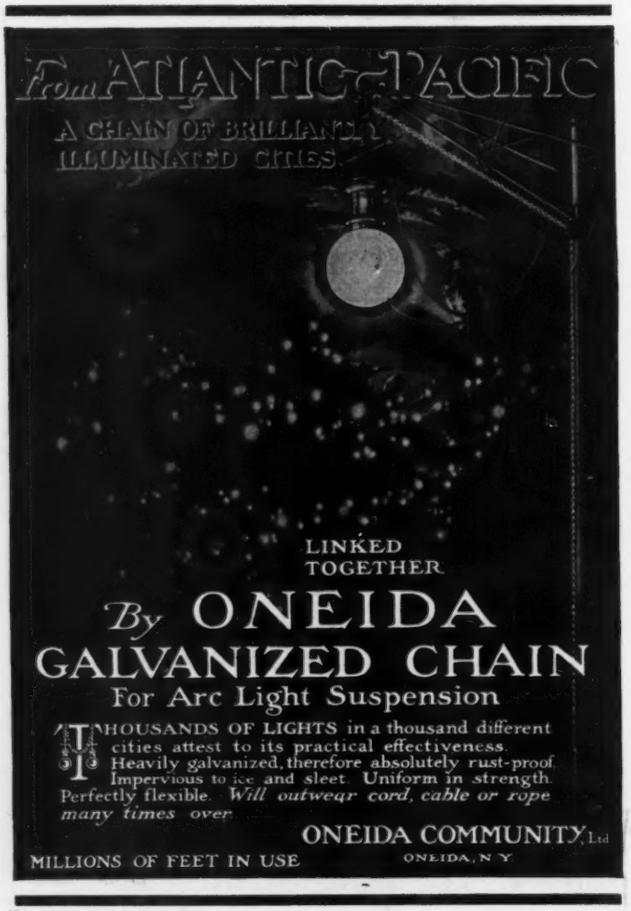
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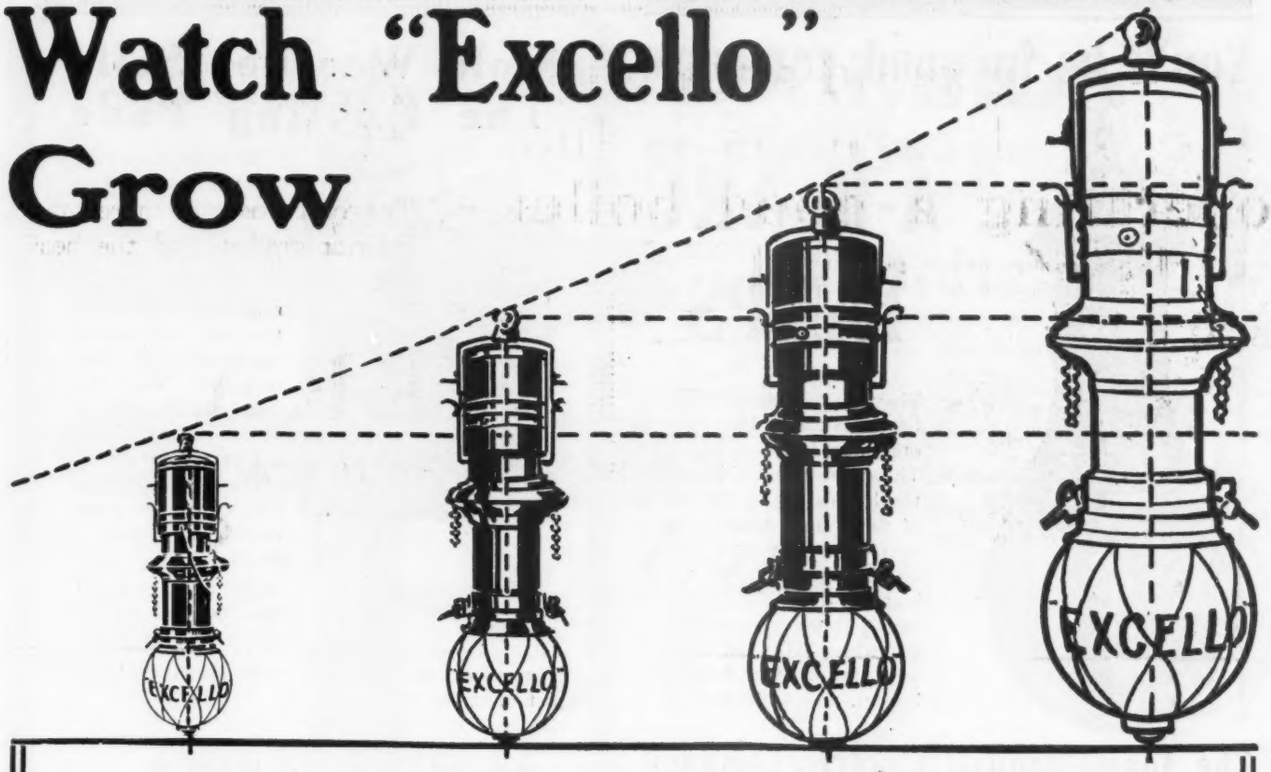

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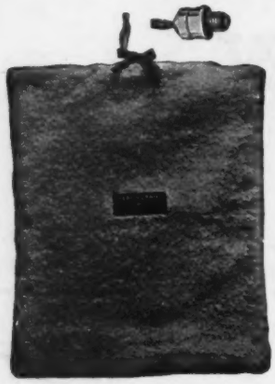

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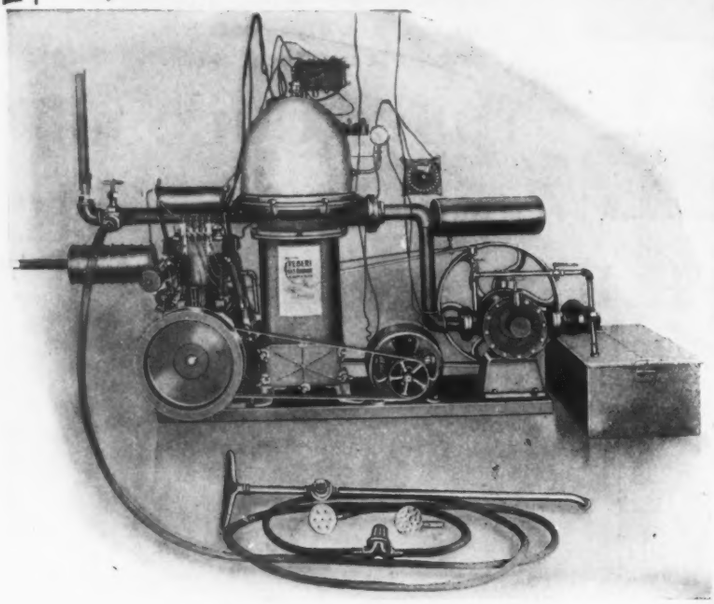

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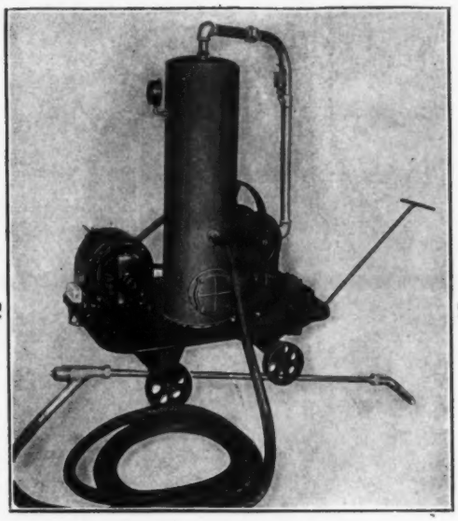

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Over ninety per cent. of the machines that we manufacture are equipped with electric motors. This means that we get one profit when we sell the apparatus, while the central station gets a profit twelve times yearly. Under the circumstances you may be interested in our mutual benefit proposition. If so, write us.

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Its photometric curve, as tested by the Electric Testing Laboratories of New York, shows that its reflection of the light will give greater efficiency of illumination than any other form of glassware. In appearance it is such a beautiful blue white it has been pronounced a perfect blending of art and science. It represents mechanical stability; does not gather dust, presents a perfectly smooth patented surface inside and out, is easily cleaned, and can be sold within reasonable limits of cost. In fact, it is a reflector that will quickly win the lead wherever it is seen.

A new and exclusive line of Fixtures which are most practical for commercial use and artistic as well, have also been developed for use with "Opalux" Reflectors, and, most important of all, they are durable and harmonize with all styles of decoration.

Send at once for our new booklet O which fully describes and illustrates "Opalux" Reflectors and Fixtures, and gives complete prices of the various styles we can furnish.

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Roughly outlined, the change consisted of combining both sets of coils on one leg of the rectangular core of the Type H, splitting the core into four flat rectangles and swinging them apart at right angles to each other.

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The original *distributed core Type H* transformer *is now accepted as a model* for transformers of small capacity for commercial service.

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3 pints—8 cups of coffee—500 watts.

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The Quick Acting Pump

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The fine nickel finish harmonizes with other table furnishings, and the Percolator is not out of place in the most luxurious surroundings.

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